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THE ANATOMY OF SNAPPING HIP

F. WOOD JONES, LONDON.

For the privilege of examining the living anatomy of two cases of so-called "snapping hip" I am indebted to the kindness of Mr. W. H. Trethowan of the Special Military Surgical Hospital, Shepherd's Bush. The particulars of the two cases are as follows:

CASE I. Bombardier, A. H., aged 26; lost grip of horse when riding in July, 1916, and when dismounted had real difficulty in walking.

CASE II. Corporal, A. E. F., aged 20; slipped in April, 1916, and has walked with a limp ever since.

X-rays and examination under anaesthesia revealed nothing. The snap was produced in both cases by the man standing and rotating his affected (right) leg while it was supporting weight. In both cases the snap could be produced by movement from extreme internal rotation to extreme external rotation and vice versa.

Both cases were treated by manipulation, contrast baths and gymnasium without improvement. On the operating table it was impossible by manipulation of the leg to reproduce the snap made during life, nor was any structure capable of causing the condition obvious from examination. The gluteus maximus was, therefore, electrically stimulated and while it was in a state of active contraction the leg was again manipulated. The snap was now elicited every time the great trochanter was rotated backwards or forwards between the gluteus maximus. Upon dividing the fascial insertion of the muscle and reflecting it towards the middle line it was at once apparent that the structure which infringed on the trochanter and caused the snap was the tendon developed on the deep surface of the muscle. This tendon constitutes the insertion of the gluteus maximus to the gluteal ridge of the femur and it

was apparent that in these two cases the tendon was in an abnormal state of development. (See Fig. 1.)

From examination of the cadaver, since seeing these cases on the operating table, I have come to realize that this tendon is an extremely valuable structure. The gluteus maximus may have but

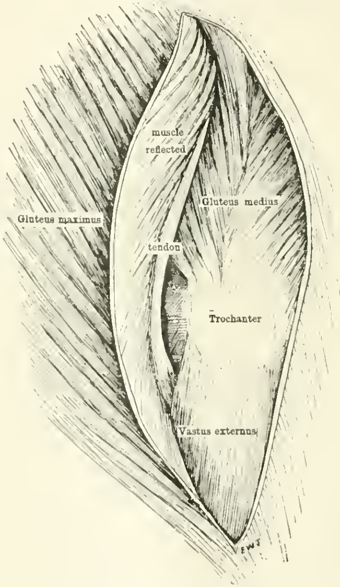


FIG. 1.—"Snapping Hip"

a small insertion to the femur effected by short musculo-tendinous fibres (See Fig. 2) ; or it may have an extremely well developed sickle-shaped tendon springing from its deep surface and passing a very considerable distance down the shaft of the femur. In these cases of snapping hip this large sickle tendon was of unusual development.

There are several points of interest in this condition. In the first place, with the relaxation of the muscles present during the operation the real cause of the condition cannot be detected, and

the surgeon is likely to blame some unrelaxed ligamentous structure. Then from a phylogenetic point of view this tendon of the gluteus maximus is of interest since this large insertion of muscle to the femur is a distinctive primitive feature, and one which is waning in man with the increasing importance of the fascial insertion. That in these two cases the tendon was the offending

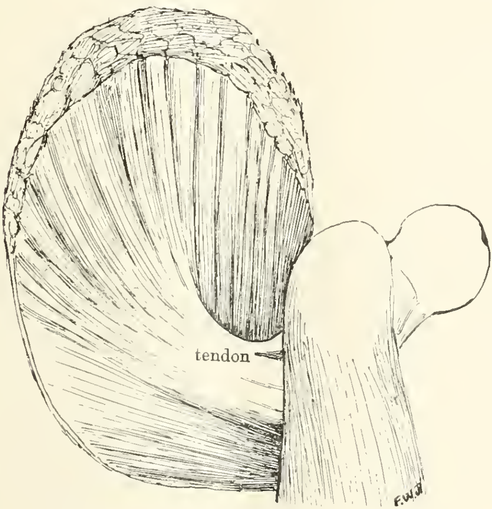


FIG. 2.—Deep Surface of the Gluteus Maximus.

structure was confirmed by the fact that stitching it down to the whole length of the great trochanter put a stop to the production of the snap. From an examination of a series of tendons in the disecting room it appeared probable that many persons would have some power to produce a snap as the trochanter passed backwards and forwards under the tendon.

I find by examining students that this is actually the case, and I suspect that in the two cases operated on the history is not reliable and that an individual peculiarity had been exploited for military purposes.

DEMONSTRATION OF RADIOGRAMS OF A CASE OF TUBERCULOSIS OF ONE HIP ASSOCIATED WITH CONGENITAL DISLOCATION OF THE OTHER HIP.

BY A. ROCYN JONES, LONDON.

British Orthopaedic Association

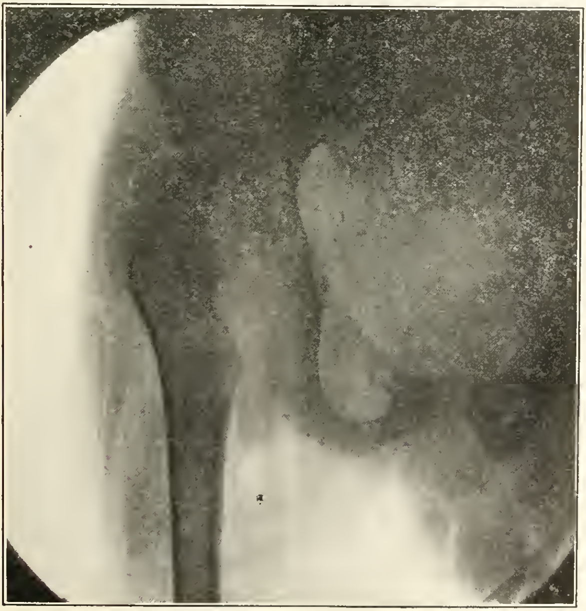
My excuse for bringing this case to the notice of the Association is its extreme rarity and the problem involved in treating, at one and the same time, Tuberculosis of one hip and Congenital Dislocation of the other.

W. B., aged 3½ years, was admitted to the Royal National Orthopaedic Hospital on May 17th, 1916, with a history of limping on the right side ever since he began to walk. A congenital dislocation of the right hip was diagnosed, and later reduced by manipulation, although the rudimentary lower and posterior acetabular rim made it difficult to be certain when the head was actually in the cup. Both limbs were encased in Plaster of Paris, the right being hyperextended and abducted 110°. In the next plaster a few months later the right hip alone was encased. The boy was ex-

1. W. B. Aged 3½ years. A radiogram showing Congenital Dislocation of the Right Hip.

amined from time to time and appeared to be doing well, but on January 11th, 1917, he was brought to the Out-Patient Department with a large fluctuating swelling on the front and inner side of the upper third of the left thigh; this being first noticed by the mother ten days previously. The boy was quite comfortable and movement at the left hip joint was free and painless. A radiogram showed necrosis of the ilium and upper part of the acetabulum. Next day eight ounces of typical tuberculous pus were evacuated through a cannula.

In order to treat the two conditions and counteract the left femoral head from upward wandering, the plaster was discarded and the boy put upon a modified double Thomas' splint with a bar along each side of the left limb and a joint, controlled by a key,



5.—W. B. The present condition of the left hip; much new bone formation with firm ankylosis.

opposite the right hip. By this means the right thigh could be abducted at any desired angle, and at the same time the left limb was continuously extended and slightly abducted.

A few weeks later a sinus appeared in the left groin but the splint allowed the daily dressing to be easily carried out, without disturbing the position of the limb. After some months the sinus closed up but in February, 1918, an abscess developed again in the groin and was evacuated. Later a sinus reformed but healed again in August, 1918, and has remained healed. The disappearance of the pus and the closing of the sinus coincided with the formation of bony ankylosis at the hip joint as revealed in the radiogram.

6.—W. B. The present condition of the right hip; the head in good position; the roof of the acetabulum although somewhat sloping shows good cupping.

Pari passu with the treatment of the tubercular joint the abduction of the right thigh has been gradually diminished so that by now the right half of the instrument is discarded and the boy allowed to exercise his right limb. But owing to the abscess and recurring sinuses of the left hip it has been thought well to continue immobilization of this limb until the completion of a year from the complete healing of the sinus. At the end of that time, i. e. a few months hence, the boy will be allowed to get about gradually. At present the boy's physical condition is better than at any time and he is putting on weight. The left hip is firmly ankylosed with the limb in good alignment, the reduced dislocation on the right side remains thoroughly stable under all movements of the thigh, but a little external rotation of the limb remains.

STRIPPING OF THE OS CALCIS.*

ARTHUR STEINDLER, M. D., F. A. C. S., IOWA CITY, IOWA.

In 1917 the writer described an operative procedure for the relief of certain cases of cavus deformity of the foot. The operation consists mainly in the subperiosteal stripping of the muscular attachments to the anterior surface of the os calcis.

Anatomical studies show that conditions are favorable for such procedure, in as much as the muscular attachments of the small muscles of the foot are concentrated about the inner and outer tuberosity of the os calcis, from which they rise in three compartments occupied by the abductor of the 5th toe, the common short flexor of the toes and the abductor of the big toe. This compartmental arrangement of these structures, their relation to the plantar fascia above, to the deep ligamentus structures below the muscles, especially the division in three compartments by perpendicular extension of the fascia to each side of the short flexors of the toes and the relation of their septa to vessels and nerves is of considerable interest as it opens a number of operative possibilities for the foot, other than the one described. Dr. H. J. Prentiss, Professor of Anatomy at the State University of Iowa, has made a thorough and most interesting study of this subject.

It appears that the vessels and nerves entering the foot below the inner malleolus are carried in closed proxmity to these septa, entering at a point in front and median to the inner tuberosity of the os calcis. There is, however, sufficient space between the vessels and the internal tuberosity to make the insertion of the periosteotome at the latter point, a safe procedure.

The operation does not intend to do more than to free a muscle bound claw foot or hollow foot from the strain of contracted musculature of the sole of the foot. Any deformity arising from abnormalities of the skeleton must be taken care of by additional bone operation.

The technic used may be shortly described as follows:

A curved incision is made horizontally from the posterior aspect of the heel in front to the inner side of the foot, reaching to a point 1½ inches in front of the tubercle of the os calcis. The upper surface of the plantar fasciae is then dissected from cover-

*Surgery, Gynecology & Obstetrics, May, 1917.

ing fat layer of the foot and made free thru the entire width of the fascia to the lateral side of the foot. The fascia is then incised across at its insertion to the lower surface of the os calcis. A sharp periosteal elevator is then inserted and a subperiosteal stripping of all structures attached to the lower surface of the os calcis is carried out. Fig. 1 and 2.

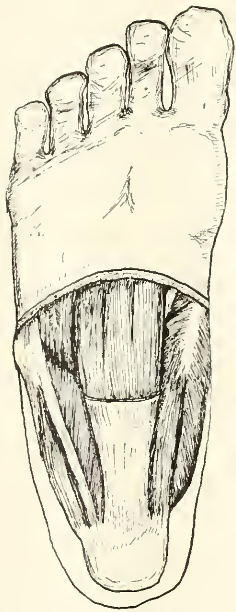


Fig. 1 - Superficial Layer of Foot Musculature. Abductors of 1st and 5th Toes and Common Short Flexor Arising from Tuberosities of Os Calsis.

It is necessary to extend the stripping over the under side of the os calcis to its junction with the cuboid in order to detach the ligamentum plantare longum, which is often contracted and the cause of the cavus deformity, at the outside of the foot. By keeping close to the inner tuberosity of the os calcis one is at safe distance from the plantar vessels and nerves. After the stripping

process has been carried out the wound is closed by subcutaneous suture and the skin is sutured with cat-gut.

In some cases this operation had to be accompanied by osteotomy of the tarsus in order to overcome the cavus deformity of the skeleton.

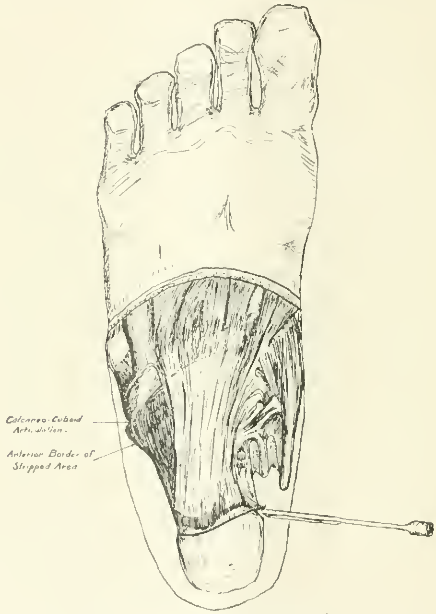


Fig 2 - Incision Through Fascia and Periostium.
Insertion of Chisel at Inner Tuberosity

In a series of other cases dropping of the first metatarsal and retraction of the big toe was overcome by Sherman's procedure, that is, by severing the extensor of the big toe beyond the metacarpal phalangeal joint and fastening the tendon to a point proximal to the head of the first metatarsal.

Since 1916 over fifty cases have been operated on with this method, comprising more than sixty deformed feet.

Infantile Paralysis:	36 cases:
Equino cavus	18 cases
Equino varus	4 cases
Simple varus	6 cases
Simple cavus	8 cases
Spastic Paralysis:	5 cases:
Spastic varus	3 cases
Spastic cavus	2 cases
Traumatic Paralysis:	4 cases:
Equino cavus	1 case
Simple cavus	3 cases

Congenital Claw Foot, Non Deforming Club Foot: 4 cases

Congenital Club Foot: 2 cases

Attention is called to two cases of Infantile Paralysis with isolated paralysis of the tibialis anticus. I believe that isolated paralysis of the tibialis anticus is very prone to cause cavus deformity because this muscle essentially extends the arch of the foot and the absence of its action, therefore, predisposes to cavus deformity.

The cases operated vary in age from 5 to 20 years, and in duration from 6 months to 18 years.

Operative Procedure Applied.

Stripping of the os calcis alone in 12 cases.

Stripping of the os calcis in combination with osteotomy in 6 cases.

Stripping or the os calcis and correction to overcome deformity, carried out in 9 cases.

Stripping of the os calcis associated with tendon transplantation or tenoplasty in 24 cases.

It should be mentioned that simultaneous tenoplasty of the Tendo-Achilles should be avoided because of the great mechanical advantage of tension of the intact Tendo-Achilles in correcting the cavus deformity.

In the analysis of final results a number of cases are omitted who have either not reported at all after operation, or have not done so for a sufficient length of time.

Cases operated for 6 mo. to 1 year:		Results:
Number of cases: 12	Good.	Walking in shoe, 9 cases. Wearing braces, 3 cases.
Cases operated on 1 year or more:		Results:
Number of cases: 19	Good.	Walking in shoes, 14 cases. Walking in braces, 5 cases.

The longest time of observation is 2 years 6 months.

I believe the operation can be recommended in cases of cavus deformity with contracture of the soft parts of the sole of the foot; also in cases of cavus deformity with skeletal changes as adjunct to osteotomy or manual correction; lastly in a number of cases of paralytic or congenital club foot or equino varus deformity as an adjunct to manual correction.

THE TREATMENT OF FRACTURES OF THE FEMUR FROM AN ORTHOPAEDIC POINT OF VIEW.

CAPT. J. P. JONES, CAMDEN, ALABAMA.

GUNSHOT INJURIES OF THE FEMUR.

Gun-shot wound injuries of the femur constitute one of the greatest tragedies of the war, not only because of the fatality with which they are attended, but also on account of the deformity and shortening so often present.

In January, 1918, Sir Robert Jones stated that the "question of fractures of the femur is essentially one of preventive surgery." Orthopaedic centers in England are constantly dealing with deformities following this injury. Many of the cases come in with 4 to 5 inches of shortening, and every variety of malposition. He also stated in January, 1918, that the mortality was far too high and that every effort should be made to standardize the treatment of fractures of the femur on the most efficient plan. "The remedy consists of leaving these fractures in the hands of specially trained men, who should be retained for this work only."

Just prior to this address Special Femur Hospitals had been formed in France and in England. The bombing of April and May forced all femur hospitals to evacuate wounded to England, where the work was carried on.

Two fundamental principles must always be followed in the treatment of Fractured Femurs:

1. Efficient fixation of the fracture with correct alignment as possible.

2. Early and frequent movement of neighboring joints.

Death when it occurs early is often due to shock, the result of direct injury. The shock is always increased by the movement of the tissues and exposure. Fixation therefore should not be delayed a moment. For the purpose of "rapid, simple and efficient" fixation there is no splint like the Thomas. The splint can be applied over the trousers, and extensions made from the boot or looped bandage around the ankle with the boot on. If a compound fracture the operation should be done in the splint; practically all of our operations were done in the splint. This

has the advantage in early cases of not disturbing the position of the fragments.

The justification of the Special Femur Hospital lies in the terrible mortality and crippling during the first two years of the war. Result so disastrous that surgeons at one time advocated amputation in all fractured femurs in France. Col. Grey, R. A. M. C., has stated that the percentage of death in fractured femur cases that reached the C. C. S.'s in 1914-15 was 80 per cent. Death rate in C. C. S. was 50 per cent. In 1918 it was around 15 per cent. The Thomas splint was first used by the English in large quantities in April, 1917, at the battle of Arras.

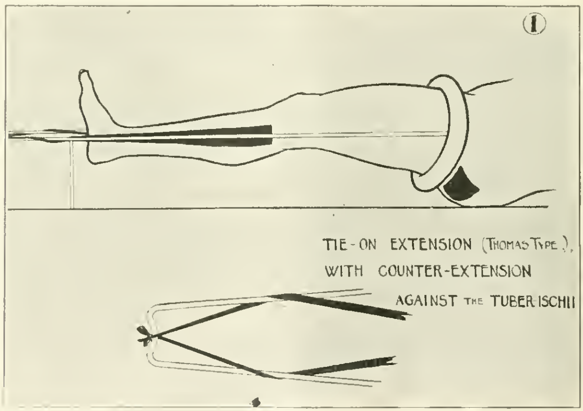


FIG. 1

The immediate result was a reduction of the mortality in the C. C. S. to 15.6 per cent. It is also interesting to note that the same time special operating teams were rushed to any point of the line where a push was on; coincident with this came the practice of *thorough excision of dead and damaged tissue* with a resultant drop in the mortality from gas gangrene and sepsis. The net result of the specialization was good; the death rate in base hospitals fell to about 3 per cent. Secondary hemorrhage was practically abolished.

Treatment of Fractures of the Femur.

The treatment of femurs has received so much attention lately that a large number of splints have been evolved. The majority are too complicated or too expensive for ordinary use. The splints most universally used are Thomas and Hodgen's or modifications of the same.

Extension and immobilization of the fracture are fixed principles that no one disputes. But there is considerable difference of opinion as to how extension is to be made and maintained and how much immobilization includes. All methods of extension come under two heads; the so-called fixed extension and the extension by weights. The Thomas splint is used in France and in England in large numbers, but in variety of ways, many of which are not actually on the Thomas principle—which is of course

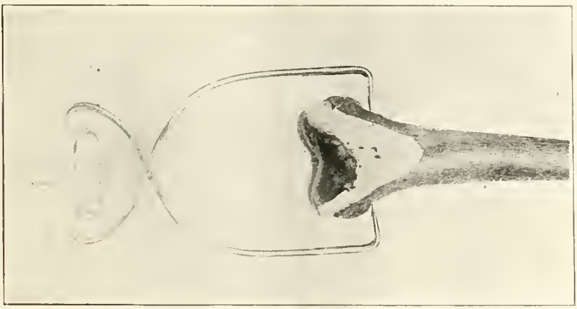


Fig. 2

that the ring is pressed against the Ischial tuberosity, and the leg tied to the other end of the splint as forcibly as possible (Fig. 1), this being true fixed extension. Another way to use the Thomas splint is to suspend the limb in it, using the splint merely as a cradle, and making the extension from an independent post by weights and pulley, or tying the limb to the post and elevating the foot of the bed. The objection to this method is the use of the entire limb for extension purposes, and the consequent immobilization of the knee.

A frequent sequel to the prolonged immobilization of a limb for the treatment of a fracture, is rigidity of joints and muscles. This disability sometimes comes to be permanent, and in most cases necessitates weeks of treatment after union to produce a movable joint. The avoidance of this complication is therefore desirable. The absolute fixation of the whole limb therefore cannot be the right principle. This brings up the question of how much immobilization includes. The older text books lay down the rule, "that when possible the joints above and below the fracture should be immobilized." This practice in the treatment of femurs is still being adhered to, and has the disadvantage that convalescence is prolonged by the time necessary to restore mobility to the knee joint. Obviously the ideal is fixation of the injured part with sufficient freedom of movement of the uninjured parts to maintain their functional activity. The Thomas splint, per se, is excellent for immediate application in First Aid, or for limited periods, but if used over any length of time, produces rigidity and wasting, deplorable because it can be avoided. The principle of fixation of injured tissues with mobility of the normal is not of course original, but its practical application so far as I am aware is not general.

Essentially there are two methods of extension; one is taken from the skin surface by some adhesive applied to the skin; in the other a direct hold is obtained on the bone by some instrument, E. G. Calipers, a pin through the head of the Tibia, or screws into the Tibia.

There can be no question that the direct pull on the bone is the more efficient, and comparing the number of cases of skin infection and sloughing following the use of strapping and glue, with the number of cases of sepsis following the use of calipers and screws, I prefer the instrumental extension. The patients who have had both tell you the same.

One of the most recent instruments is that devised by Major Besley, U. S. A. M. C., and called by him "Ice Tong Calipers." (Fig. 2.) For the simplicity of application and small amount of injury to the bone it seems superior to other instruments, while giving absolute control over the fracture. We have used this instrument with modifications by Major M. Pearson, R. A. M. C., for some time. He has used it for over a year.

Put very briefly, our method consisted in weight and pulley extension applied through the "Ice Tong" calipers to the lower end of the femur, "which they grip but do not penetrate." The lower part of the limb is free, flexed and supported on a knee flexion splint grafted on the Thomas at the level of the knee. The third thing that we insisted on was the suspension of the ring, so that it rested at all times against the Ischial tuberosity. This was done by counter-weights and pulleys or by a string from an

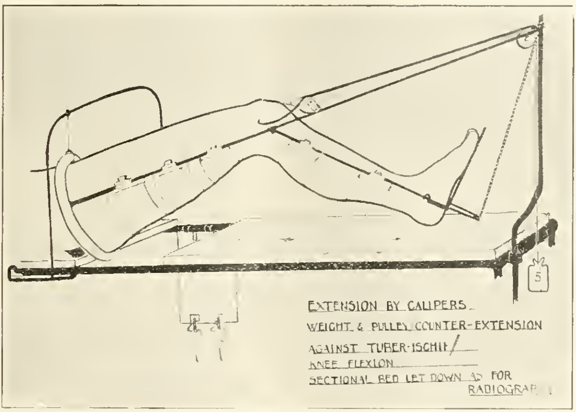


Fig. 3

overhead bar. The pull from the calipers is taken by a cord to a metal ring shaped to resemble a hexagon. The weights are attached by a cord to the other end of the metal ring. The hexagon allows full extension of the leg. (Figs. 4 and 5.)

By using counter weights to suspend the ring one can treat a fracture on fracture boards. We used a special fracture bed, in which a section dropped out and the bed pan was inserted from below. This method obviates moving the patient, thereby increasing his comfort. This arrangement is comfortable for the patient and permits him a reasonable amount of movement without disturbance of the fracture; gives ready access to the wounds, and can be placed in any degree of abduction desired.

I know of calipers remaining in twelve to fifteen weeks without giving trouble, but in my opinion five to seven weeks is long enough with the average case. After that time when some active movement is permissible and desirable a simple weight of five pounds and a glue or strapping extension to the leg or thigh is sufficient to hold him in the splint and prevent shortening.

There is one other point of interest in the use of the caliper —that is the treatment of lower third fractures. With the knee slightly flexed the calipers pull over a fulcrum with the result that the lower fragment is tilted forward, over extension is prevented by the Vastus, tightened by the flexion of the knee.

The skin around the knee being already shaved, swabbed with a solution of flavine in spirit, (1 in 500) and surrounded with sterile towels, gas may be given. The application of the calipers is not difficult and is made easier if the thigh has previously been lifted well forward in the splint by tightening the flannel bands under it. Certain apparently trivial details make a great deal of difference to the subsequent comfort of the patient. The skin over the inner and outer condyles being drawn up and slightly forward so that it shall not be tight over the patella. A cut is made with a narrow scalpel through the skin, B1PP is rubbed in, and without relaxing the skin the sterilized caliper points are inserted. The skin puncture must be large enough—about an inch—to let the caliper points go through easily and not be a tight fit. And the points must go right down to the bone, any intervening piece of fascic will lessen their grip. But they should not enter the bone, still less is there any need to drill the bone. The exact site of insertion is important. With the most ordinary care as to landmarks there is no fear of puncturing the knee joint. The available area of safety is a good deal more than the width of the thumb; (See Figures 9 and 10), at the inner side of the landmarks are easily found; the cut should be made a finger's breadth on the proxinal side of the adductor tubercle, not on its tip. At the outer side the guide is less definite but the site for puncture is proximal to the most prominent point of the outer condyle and in front of the ilic-tibial band. The latter or rather its junction with the intermuscular septum is easily felt in oneself if one stands with a leg extended straight out in front unsupported. It is not so easily felt in an unconscious patient with lax muscles and a slightly flexed knee, but it can

be felt and it is a matter of some little importance because that band moves backwards and forwards in subsequent movements of the knee and if penetrated may drag on the caliper and cause pain.

Roughly speaking the outer point of insertion is about 1½ inches from the outer border of the patella above its middle. The only common mistake in putting on these calipers is to put them too far forward, in front of the broadest diameter of the bone, they then grip a sloping surface and tend to gradually slide further forward and drag the skin, this especially on the inner side, which is the more sloping.

The blades being inserted the surgeon holds them firmly while the orderly ties up the handle ends to the hexagon as shown in Figure 6 and carries on another cord from the hexagon over the pulley to a brass spring hook into which the sand bags are hung. For any recent case, say under a week old, one ten-pound weight is ample. For older cases if there is shortening of two or three Cms. up to fifteen pounds may be required at first, reducing as the limb lengthens.

The weight now being on, the surgeon can relax his hold of the calipers which will continue to hold securely as long as the pull on them is maintained. Nurses must be instructed that on no account must the weight be removed or lifted for that would immediately loosen the hold of the calipers and possibly dislodge them.

While the patient is still under gas the old gauze and glue extension or any other form of extension below the knee is removed and the knee flection piece slightly lowered. Provided the orderly has everything well prepared beforehand, it is quite easy to do it all under gas in a very few seconds but anyone who has not done it before might be wise to use ether. The only dressing used is a narrow strip of flavined gauze at each point of insertion.

As to the mechanics of the caliper, the principle is exactly that of the ice tongs, the stronger the pull, the firmer the grip. Alos the inward grip of the points is greatest when the cord joining the handle ends is straightest and it should be made so. In the simple ice tong pattern of caliper as originally used the points were inserted, not merely down to but right into the bone.

There was a continuing tendency for the points to be driven into the bone, deeper and deeper, opening up cancellous tissues, causing persistent sinuses, and in one or two cases it has happened that the knee joint has been infected. This cannot happen with the form of caliper, a modification of Besley's which we are now using with an adjustable screw-bar between the handle ends.

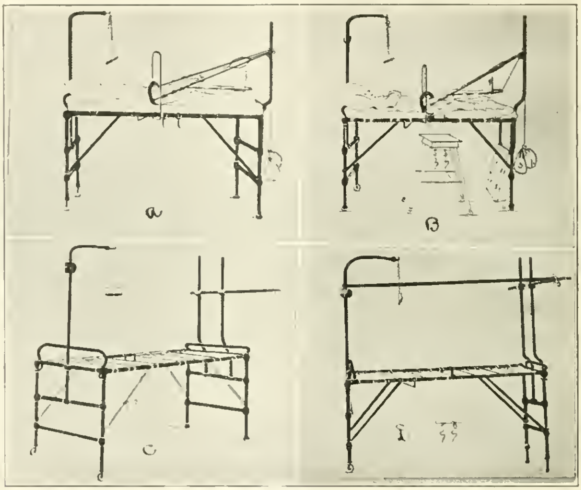


FIG. 4

When the calipers are on and have got their grip firmly on the surface of the bone this screw is adjusted so that daylight is just visible between its ends. In most cases this separation lasts many weeks showing that penetration is very slow to occur, if at all, and the check bar prevents it from ever becoming more than of the slightest.

The efficiency of this method of extension depends upon the counter extension of the tuber ischii pressing against the ring of the Thomas; that alone prevents the weight from gradually pulling the patient down the bed. The relative position of the tuberosity and the ring must therefore be frequently scrutinized by

the surgeon; as long as the ring is suspended there should be no trouble. There is no need to tilt the bed. One must remember that the end of the Thomas is fixed to a wooden upright.

Owing to the very high mechanical efficiency of a weight pulling directly on the bone instead of sliding through layers of skin and muscle, a 15-pound weight is ample in most cases and this is not enough to cause painful pressure of the tuberosity against the ring. In the rare cases where pressure there is painful, slight tilting of the foot of the bed will make the patient slide away from it, ease the pressure on the tuberosity and the counter extension in that case becomes the patient's own body weight; practically his splint then acts as a "Hodgen" instead of a "Thomas."

When there is a wound in the region of the buttock a half-ring Thomas or "Hodgen," with the bed tilted at the foot, gives efficient extensions and makes dressings easy.

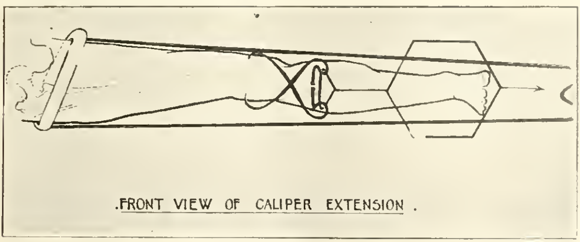


Fig. 5

If the fracture is in the upper fourth, the proximal fragment requires a position of abduction, flexion and slight external rotation to get the correct alignment, the leg and lower fragment must be moved into the same position. Instead of one extension post at the foot of the bed, two are put in, and a third bar clamped horizontally across the other two at any desired height and projecting as far beyond the side of the bed as necessary, affords means of fixing the lower end of the Thomas with any degree of abduction and flexion desired, and yet leaves easy access to all parts of the patient. The position of the bone should be checked by radiography for it is very easy to over-abduct. (Fig. 4c.)

In spite of precedent the practice of abducting and fixing both legs is unnecessary and I think surgically unsound. It is based on a false analogy with abductions of the tubercular hip. In the cases we are dealing with the alteration of position takes place at the fracture, not in the hip joint, and abducting the leg below the fracture is simply restoring its natural line and putting it into the position of greatest ease. The patient has no inducement to "dodge" it by tilting the pelvis and as a matter of fact he does not do so. This is obvious to the naked eye on examining cases, but in addition we have accurately measured the true angle of abduction of the injured leg, there is no difficulty whatever in getting and maintaining 25 or 30° of true abduction, the sound leg being left free.

This is a really important point. Not only is it a great comfort to the patient to have his good leg free while he is in bed, but it aids nursing, and when the time comes for him to get up and about he has the great advantage of starting with one good leg, instead of both being more or less atrophied and stiff.

The method here described is our routine method for all fractures, simple or compound and the patient remains in this "first position" for several weeks until in fact there are definite signs of union and normal temperature. Movements of the leg, at first only through a few degrees, afterwards more freely, are carried out daily *by the surgeon himself* from the very beginning.

When union has begun the second position is adopted; the only change being that the lower end of the splint instead of being closely tied to the extension post is now swung from above by a cord, weight and pulley, the pulley being fixed to the top of a spare derrick or other overhead suspension at the foot of the bed. This allows the patient greater freedom of movement. At this stage the weight extension in the line of the thigh is necessarily done away with and its place taken by elastic or spring extension inserted between the hexagon and the end of the splint. A very handy and efficient form of a spring extension is a small spring balance; a glance at the indicator shows at once whether it is doing its duty and what its pull is. Its efficiency depends entirely upon the counter pressure of the tuber ischii on the ring and this must be maintained.

The later stages will not be detailed here. The patient becomes more convalescent and his femur less and less dependent upon extension apparatus. His knee and ankle are kept mobile throughout and long before the thigh is able to bear the patient or indeed any weight on it, he is able to get up and walk about on the Thomas. "Walking Caliper Splint," with the special light boot supplied.

The advantages of calipers as a means of extension are so manifest, their mechanical efficiency and directness, the freedom of all the leg and joints below the fracture, the fact that they can be applied irrespective of the position or size of wounds of the thigh (very satisfactorily even through an open wound) the absence of blistering of the skin—all of these look so ideal that it is well to look for their disadvantages and limitations.

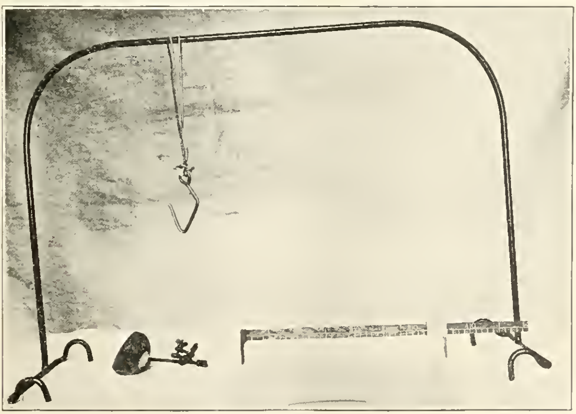


FIG. 6

(1) Pain is present for the first day or two, sufficiently to make it worth while giving a hypodermic of morphia gr. 1/4 before giving the gas. In most cases there is no further pain worth mentioning and patients often keep their calipers on for 12 or 14 weeks and say they are hardly conscious of their presence. In a small

minority there is pain, even severe pain at some stage or other, and then generally due to some error of technique.

(a) Too small a skin incision causing a "pressure leucocytosis" and retention of a drop of sterile pus under the skin, movement of the skin will generally release this.

(b) Wrong placing of the points,—too far forward, where they have a tendency to slip further forwards or too close to the top of the adductor tubercle which seems to be a sensitive point.

If no cause can be found and pain is really severe gas should be given, calipers withdrawn, and a new pair inserted through fresh punctures half an inch higher up. As a general rule Caliper extension is much less painful than is glue extension.

(2) Penetration of the bone should not occur with this form of caliper furnished with a screw check-bar. In no case that we know of has there been necrosis.

(3) Sepsis, or rather the fear of it has been a great bogey. Anything more than the pressure leucocytosis above referred to does not occur and that is easily controlled. We have never seen any bad effects, but we have heard of one or two cases of penetration and infection of the knee joint where patients have been sent on long journeys with ice-tong calipers deeply in and unfurnished with a check-bar. Calipers in any form are unsuitable for transport purposes.

There is no difficulty about the healing of the wound when calipers are removed. It is generally closed and dry by the third day and remains so.

(4) Involvement of the knee-joint in the fracture is in our opinion usually a bar to the use of calipers, and for two reasons: distension of the synovial cavity by fluid lessens the space available for insertion of calipers and might cause risk of puncture of the joint; and also where there is sepsis in a splint between the condyles pressure of the caliper points towards each other would tend to shut in this sepsis.

Radiography should be very freely used and always done in the ward, using a portable trolley apparatus. In the first week or two this may be necessary several times; in later stages less frequently. Once in two weeks is a fair average throughout. A. P. and Lateral views serve well. The plates used are 12 x 6. From them, with the help of a reducing lantern and camera, a small positive print is made. These reduced prints are kept at the bed head of the patient, the series forming a radiographic history of the case as well as being a constant reminder of the nature of the deformity to be corrected.

FIG. 7.—Splints Worn During Day.

EXPLANATION OF FIGURE 6.

The V shaped hook is used to suspend the ring of the Thomas splint and owing to the shape it grips wherever it is put and so gives some internal or external rotations of the splint if desired.

The measure graduated in centimeters and with a sliding point enables one to measure a femur more accurately and easily than with a tape and without disturbing dressings.

The screw pressure pad is useful to correct any bowing or bending of soft callus. It gets its attachment from the side bar of the "Thomas" splint, and is used in pairs very effectively.

Management of Fractured Femurs.

Success in dealing with these cases depends on two salient principles:

1. Team work.
2. Attention to detail.

In no class of case is the necessity for team work more in evidence than this particular class.

There are certain points which must be dealt with by the medical officer himself; others which are the prerogative of the nurse, others for the masseuse and still others for the orderly.

Each and everyone should be trained in his or her particular portion of the work. All ranks must appreciate the importance of delicacy of touch and movement; bumping against beds is sheer clumsiness excusable only in the very new hand.

In most cases the medical officer will be able to leave the dressings to the nurse and he should concentrate his attentions on the efficiency of his extension and the correctness of his mechanics as evidenced by the position of the opposing ends of the fracture and the length of the limb.

Into his sphere of action will crop up the minor operations associated with the opening of abscess cavities, the removal of sequestia and in late stages the plating of ununited fractures and perhaps suture of divided nerves.

The actual control of the fracture will entail a considerable amount of work on the part of the medical officer.

By inspection, palpation, radiography and measurement he will get complete information as to his success or otherwise in correcting the disability or deformity.

He will find that he will in many cases need to make gross alterations in the original position in which the limb was put. He will in most cases from day to day need to make minor adjustments.

These adjustments consist of increase or decrease of abduction, adduction, more or less flexion of joints, tightening of posterior slings, progressive use of pressure pads, attention to cord and pulley, etc., etc.

Unless the medical officer is prepared to give his undivided attention to these various points he is inviting failure to achieve the high percentage of perfect results which the system permits of.

The Masseuse.

She will take her orders from the medical officer and these should be definite.

In a case in which extension is applied to the femur through the medium of calipers, her duties will be exactly defined.

She will massage the foot and leg up to the knee. The toes and ankle are to be freely moved actively and passively but on no account is the knee to be moved.

All the movements of the knee must be done under the direction of the medical officer. It may be that the knee is exactly flexed to correct the backward displacement of the lower fragment in a lower ⅓ fracture; it may be a simple case with calipers in position pulling on the condyles.

No matter what the case the medical officer is the only person to apply the principles of movement to that particular joint.

In late cases with fairly firm union and with no extension on the masseuse is given a freer hand. She may now move the knee within the limits of its freedom but no attempt to increase the range of movement by actual force is permitted. The methods of attaining a freer range will be described later.

In all cases without wounds above the knee a certain amount of light massage to the thigh is permissible at all times.

The Nurse.

Apart from the actual attention to the comfort of the patient she will be given a large percentage of the dressings to do and there is a definite system on which the average dressing should be done.

The bed is constructed so that a moveable section may be let down under the wound with the object of facilitating the dressing.

1. Before this is let down the first duty of the nurse is to see that the ring of the Thomas splint is neither too far up the bed nor too far down. It should rest just on the lower edge of

the upper biscuit. If it is too far up the bed then the letting down of the section does not clear the field of operation as much as desired. Some of the thigh will be obscured by the upper biscuit. If the ring is too low then directly the section is let down the patient tends to sag into the opening and is only supported by the hook and cord supporting the ring.

2. Having attended to these details the nurse proceeds to the actual dressing. In all cases when calipers are applied the care of the points is the first portion of the dressing. It is a sterile operation and must be attended to before any other portion of the dressing is done. An alternative is to make the dressing of all caliper points in the ward a separate operation at a special time. The dry gauze soaked in 1 in 500 Flavine in spirit solution is applied round the points and changed every second day.

Should there be discharge round the points, a not uncommon complication, a little of the solution introduced through the needle of a hypodermic syringe passed along the side of the caliper point will control the discharge and in most cases get rid of it after a few applications.

Repeated examinations of this discharge have invariably demonstrated its sterility. It consists of polymorphonuclear leucocytes and fibrin.

In dealing with the actual dressing the guiding principle is the non-disturbance of the fracture. The limb is supported in three slings and in the vast majority of cases it is possible to approach the wound by letting one sling down without permitting the fracture to sag. Having irrigated and dressed the wound the sling is replaced and the other two can be released in turn to allow the adjacent skin to be attended to.

In the event of its being necessary to let down two or more slings at once, there is a simple device that gets over the difficulty.

If two narrow strips of pliable aluminium are taken they can be bent over the splint and under the thigh one above and one below the fracture so as to support the limb. The slings can then be removed without the fracture sagging and the narrow strips do not interfere with observation of and attention to the wound. This device is invaluable also for operating on the patient without taking off his splint or interfering with his extension. The whole dressing should be and is capable of being done

without movement of the fracture and with a minimum of pain to the patient.

Having completed the dressing the nurse then takes a prepared strip of calico boiled in soft soap, passes it between the rings and the skin and soaps the ring and skin by a to and fro movement. This device diminishes tendency to pressure sores.

The back is rubbed with spirit, the section re-applied and the dressing thereby completed.

The Orderly.

The duty which needs to be explained to the orderly is that of the application of bed-pan to the patient.

For this purpose the sectional canvas and mattress is let down. The sound leg is bent up at the knee and the bed-pan is passed under and placed in position from that side. The canvas without the sectional mattress is then fastened up to support and keep the bed-pan in position.

The orderly should also familiarize himself with the use and application of the various parts of the apparatus. When requested to do so he should be able to assemble and erect the frame for abduction, to fit the knee flexion pieces to the splints of patients newly arrived, not forgetting the transferance of slings from the rigid to the moveable portion, the foot piece and chain. He should be thoroughly familiar with the method of transference of the patient from stretcher to bed or vice versa. An orderly who embodies all these assets will be found invaluable in the smooth running of a ward.

We have now to consider in some detail the late management of a case. When wounds are healed and there are signs of fairly firm union th calipers may be dispensed with. As to when this will be one, may not dogmatise but in the average case it should be about the end of the third month.

It was then our practice at one time to take the limb out of the splint and begin flexion of the knee over a pillow. This proved fallacious in its results. The extra latitude permitted to the patient by the removal of the splint while apparently desirable actually contributed most to the defeat of the end in view.

The pillow needed repeated adjustment. If the patient found it irksom he could and did slide it down to support the calf or turned his leg on its side. Worst of all it was found that in certain cases, the thigh unsupported, sagged backwards at the seat of fracture and the work of months was marred and to a certain extent nullified.

The method in short was rough, incapable of accurate control, inefficient and altogether unscientific.

The present method has been found to satisfy all the requirements.

On removal of the calipers it will be found that the knee has an effective range of movement of 25 to 30°. This can be increased to 90° in a simple way.

The arch at the foot of the bed is brought further up the bed and the rigid Thomas splint is cocked up on this like an anti-aircraft gun. This gives a greater range of movement to the flexion piece and this range can be increased from time to time by advancing the upward tilt. In this way a movement through an angle of 90° can be attained in ten days to three weeks time. It is an excellent device to tie a cord to the foot of the flexion piece, bring it up vertically, then through a pulley to the patient's hand. He can then passively move the knee himself. During this period the thigh is supported in its sling and any tendency to sagging thus prevented. Tendency to bowing can be controlled at the same time by lateral bandages or screw pads. The graduated tilting of the splint has the added advantage of flexing the hip more and more and thus restoring its antero-posterior movement.

The next stage is the fitting of the patient with the Thomas knee splint, unfortunately now called the walking caliper.

The wounds should be healed and the union of the fracture firm. The medical officer will have noted that during the several weeks while extension was not operating and the knee being moved, there was no marked tendency to shortening or bowing. He will by attempt at lateral bending obtain direct guide as to the firmness of the union. He will determine that the callus is plentiful and not tender to pressure and lastly he will note in the most recent radiograph the position of the fragments, the amount and distribution of the callus and most important of all its density or rather homogeneity.

A callus that is honey-combed and irregular no matter how profuse will not stand strain like a callus which is homogeneous in its consistency.

A history of prolonged sepsis is usually associated with the presence of honey-combed callus and in certain cases this will be found to have invaded adjacent muscles producing a local myositis ossificans and consequent disability.

Having satisfied himself that the patient is ready for a walking splint the medical officer will measure him as follows:

1. Circumference of thigh at level of Tuber Ischii.

2. Oblique circumference of thigh from Tuber Ischii on inner side to a point midway between the Crest of the Ilium and the tip of the great Trochanter on the outer side. The difference between these two measurements is usually from 2 to 2½ inches.

3. From Tuber Ischii to the sole of the heel.

These measurements are supplied to the splint maker. He adds a little to the last measurement to allow for the turning in of the ends under the boot and the modern adaptation of the splint has a sliding adjustment by which the splint can be lengthened or shortened to allow for shrinkage of callus or other shortening of the limb. This is liable to occur in the first few days and can thus be dealt with easily.

The patient should wear the splint during the day for at least three months. He should take it off several times each day in order to exercise his knee so that when the goal of his ambition is attained coincident with the discarding of the splint, he may walk with rigid bones and mobile joints.

N. B. One may use an ordinary Thomas splint with small ring. Measure to level of heel, allow one and one-half inches, so as to clear heel from heel of boot. Bend at this point.

The holes in the heel of the boot should be carefully placed. The one to the inner side should be about 1½ inches back from instep portion. The outer is about ½ an inch from the instep portion. This causes the shoe to point outward. The sole of the other boot should be raised one inch.

271	Cases Treated.
66	Still Under Treatment.
205	Results.

Average shortening for above, 0.48 C. M. on application of walking splint.

6 with an average of 5.7 C. M. shortening on arrival.

6 with an average of .4 C. M. on departure.

Calipers on 120 cases from beginning to end of treatment.

Average shortening at end, 0.5 C. M.

Walking Caliper worn an average of 60 days in those cases that had union in about nine weeks.

THE TIME ELEMENT IN RECONSTRUCTIVE SURGERY

By R. W. Johnson., Jnr., Baltimore.

The war has done an immense service to humanity in the enforced development of the reconstructive side of surgery, and has demonstrated to the profession at large its possibilities, of which only a few enthusiastic idealists dared to dream before. However, this small group of orthopaedic surgeons, led by Sir Robert Jones, has proved the practicability of first saving limbs and then making something of them. This ideal is now firmly established for all time and will apply to the industrial injuries of peace as well as to war wounds.

Reconstructive Surgery is orthopaedic in origin, principle, and guidance, and so has fallen heir to the methods and ideals of civil orthopaedics, which since it deals largely with children has been able to disregard time in pursuance of treatment. Also it is a new development and by its wonderful success has fired the enthusiasm of all who have practised it. But this very enthusiasm is a danger, for it may lead us beyond the limits of the soundest and fairest point of view in our consideration of the individual case. Therefore the danger of disregarding time is due to two causes—old habit and new enthusiasm. Consequently I feel that it must be doubly emphasized, and since I have been made to experience personally as a patient the importance of time consumed in treatment as well as to see the part it plays in the lives of my patients, I trust I may be pardoned if I make the brief for its consideration a strong one.

It is axiomatic that reconstructive surgery to be successful must be careful, thorough, and very often gradual and slow. We cannot afford to be hurried by our own impatience or the temporary discouragement of the patient. We must take *our* time, but we must also remember we are taking *his* time. Our first consideration should be "What can be done for this man's disability?" but our second should be "How long will it take to do it properly and carefully?" Those questions the surgeon can answer from his professional knowledge and experience, the first in terms of physical improvement reckoned on a percentage basis, the second in terms of days or months of (a) Hospital in-patient treatment,
(b) Out-patient treatment.

That will suffice for the injured limb itself, but reconstruction deals with the man as a whole, not with an isolated part of his body. To deal with the man it is not enough to be a good surgeon; one must be something of a political economist, since the man's earning capacity is at stake; a bit of a psychologist, since the man's morale is involved, etc. In short the reconstructive surgeon must be a man of "understanding" who is prepared to be the guide, philosopher and friend of the patient. To be this he must appreciate fully the factors in the patient's life which give the Time Element its importance.

A. Factors.

(1) First in importance is the *End Result* aimed at by the proposed treatment. This must be carefully determined, and a fair estimate on the percentage basis must be made as to the improvement to be expected, judged purely by the standards of function, occupation, earning-power, and ability to seek pleasure and recreation. Then we must consider the surety we have of getting the expected result. In some cases this will be 99 to 100%, in others 50%, and so on, and to be fair we must modify the first percentage estimated in proportion to the surety. With these two estimates made we have an End Result fairly determined to offer the patient. The physical improvement is so great in the vast majority of cases that it outweighs all the other factors and justifies many times over the time spent to obtain it—for instance tendon transplantation done in irreparable Musculo-Spiral nerve lesions of the middle third of the arm.

(2) Then comes the question of *TIME*—pure and simple—days, months, even years of the patient's life to be consumed in treatment.

(a) In children this factor, as well as most of the others discussed, may be almost entirely disregarded because growth, education, etc., can go on without appreciable curtailment.

(b) In the young adult the question becomes a real one. Time spent in treatment is partially wasted. It must be estimated for each case, from observation of the patient and the environment how much use he can and will make of his life during the period of his treatment. At this stage of a man's career the time consumed is immensely more valuable.

(c) In the thirties and early forties we are taking part of the most productive years of a man's life, a time when, if he is married, his family is most dependent on him as a wage-earner and head of the home. Unless then the fruits of treatment are soon realized he begins to enjoy them only when his strength and powers make him less able to profit by them.

(3) *Condition of Life.*

(a) Personal and Family. A single man is more justified in exchanging time for physical improvement than a married man, who must consider the support and upbringing of his family, and the surgeon must take into account not only the man, but also the whole family circle involved.

(b) Financial. This question is a civil one, for in military or industrial cases it may be neglected as part of a man's life, except as it involves his future earning capacity, which subject will be discussed in the next paragraph. In civil life it is a real problem, not only for the man but also for the surgeon, the hospital and the State. In cases of wealth it is easy, but for the middle and laboring classes it is a tremendous and oftentimes insoluble problem. It is one of the failures of the present civilization that a cripple may not be able to afford to undergo curative treatment. That is a problem outside the surgeon's field, for he frequently enough does "charity cases", and it remains for society to right this wrong. The surgeon can only consider it as it applies to the individual case, and urge it on the conscience of the community.

(4) *Occupation.* This is always considered strongly in the plan of treatment, but do we think of it enough as regards time? For example, is it always wise to spend valuable time working over a more or less useless leg, when it might be much better applied to learning a new and possible trade, since a change of trade may have to be made eventually in such a case?

(5) *The efficiency of mechanical substitutes or aids to accomplish the lost function.* For instance the hand is worth infinitely more time than the foot, as the artificial foot is a fairly efficient substitute while the artificial hand is a poor contrivance at best.

(6) *Hospitalization or production of chronic invalidism.* This is, to my mind, the most insidious evil of prolonged treatment and the one most difficult to combat. Treatment must, by the nature

of things, be long and tedious, and if the time passes quickly for the surgeon it drags wearily for the patient. We all know, only too well, the expression "fed up". In reality the man who is "fed up" is the one who is least hospitalized. He is the man with native energy and ambition whom hospital life and routine have stifled and suppressed. That man, while he is the hardest to treat, can stand it the best, for when he gets out he will soon regain his keenness and energy. His mind has kept partially awake by its rebellion against the one-toned environment. He will be glad to get back into the struggle with a tangible world, partially disabled though he may be. His mind may be rusty, his muscles flabby, his fingers clumsy through lack of practise at his trade, but he has not lost his nerve, his ambition or his love of contest.

There is another type and a common one, the patient, long-suffering, but listless man, who earns the reputation from the sisters of being a "fine patient." That he is, but he is likely to become more or less of one for the rest of his life. The phlegmatic, lazy, easy-going types run grave risk of being permanently hospitalized. They lie in bed for four or more months in many cases, are waited upon for every want, read trashy books if any, but chiefly gaze idly at the ceiling or talk trivialities with their companions. Then comes a long period of walking convalescence with at most 1 to 1½ hours treatment, massage, etc., to occupy them, and the rest of the day is spent in idleness. Aside from the pain and strain of such long treatment, the ennui has so eaten into the very fibre of the man that it is problematical if his ambition or energy will ever return to their former pitch, and a certain proportion never have the courage to face the world with their remaining disability plus the engrafted habit of idleness.

I have barely touched on this hospitalization phase of the Time Element, for it is the most indefinable as well as the most insidious, but to one who has gone through it, it seems to be as dangerous as it is likely to be overlooked.

(7) The last factor involved in prolonged treatment is the *General Health.* This applies chiefly to septic cases, but it is just this type of case with which the wards of the hospitals are now crowded—old compound fractures. There is a period in the history of many of them when the die must be cast for conservatism or radicalism. Early, the saving of life is almost the only indication for radicalism. Later, when time has shown what sort of a

course such a case is likely to run, the ways of conservatism and radicalism divide and a decision must be made as early as possible as to whether the end result will justify the conservative course. Then it is that the Time Element comes to the fore as a factor which should influence the decision. If the prognosis is distant we must consider the effect of the prolonged sepsis on the general health. There is absorption from the best drained of bone cavities, minimal but nevertheless toxic, and when one is faced by the possibility of recurring deep abscesses, burrowing pus, and other conditions giving rise to sudden increase in the absorption of these toxins, there is good cause to fear for the effect on the general health. In joint infections this is particularly true, and in these cases conservatism must face the question of Time in relation to general health and justify its course by showing decided benefits to be gained thereby which outweigh the risks.

(8) *Pain.* The effects of pain are so intimately connected with general health that they must be considered with it. When we recommend prolonged treatment we often ask the patient, in other words, to undergo a considerable amount of unavoidable suffering, pre-operative, post-operative, from the dressing of septic wounds in certain cases, massage and mobilization, etc., extending over a long period, and that pain, both in its intensity and especially in its duration, tells on a man, tells on his endurance and his reserve. That pain, which we ask the patient almost glibly to undergo, must be examined in the light of the Time Element, and the amount of benefit, eclipsed by the shadow so cast, must be deducted from the valuation of the end result.

B. Having shown above the very real value of Time in its various ramifications, and having pointed out some of the subtle dangers to the patient of prolonged treatment, let us turn to how these disadvantages may be avoided, or at least minimized.

(1) *The short cut of Radicalism.* This is a course which is the solution of the problem too frequently for the general surgeon, but too seldom, I fear, for the reconstructionist. I can recall several cases, with through and through septic wounds of the tarsus, which would be walking more comfortably today had I sent them out with a good Syme's stump instead of spending 8, and in one case 11 months, overcoming sepsis, and in the end getting a foot, with moderate mobility it is true, but which will give pain on even slightly rough ground and which will act as a barometer to

the man for years to come. Yet those feet were always just tempting enough to make me avoid the sacrifice, and I must in all honesty confess that I charge myself with the waste of the extra months of the men's lives spent in saving their feet. Septic excised knees, where infection of the cancellous bone ends is well established and chronic, I have given up wasting time over as a rule, for in the end I have found that the man rejoices in a painless stump and pylon, after months of discomfort in plaster and pain in trying to walk with a caliper.

(2) *Conservatism.*

(a) *Without proper organization and equipment.* This is fraught with the grave dangers of hospitalization and can only be truly successful when the time is relatively short or the benefit expected is proportionately large. It is not wise in the borderline case, for hospitalization quickly counterbalances an improvement of only moderate degree. Also if the patient is under treatment for a long period without the aids of workshops, etc., he quickly goes stale, loses interest in his condition, and then the surgeon is at a grave disadvantage, for unless he has the active, eager cooperation of the patient he will fall far short of his intended goal. The will to get well, and the concentration of effort and attention of the patient are as essential to good results as skilful treatment.

(b) *With proper organization and equipment.* This is true *reconstruction* as distinguished from reconstructive surgery, and as yet I do not think we have quite attained the utmost in it. When we have attained perfection the importance of the Time Element will have almost reached the vanishing point, and already in the Military Reconstruction Hospitals it has been minimized by the workshops, bedside occupations, etc.

I wish to pay a tribute to those who are responsible for the initiation and organization of the workshops at these Military Reconstruction centres. I have had charge of a group of beds both before and after the establishment of a workship, and I can truly say that the improvement in the general happiness and contentment of the men, and in their morale has been unbelievable. The men take more intelligent interest in their disabilities and help the surgeon and staff more effectively in overcoming them, and very rarely refuse operation. The direct curative side of the shops is immensely valuable, and in such an occupation as basket-making

for injured and stiff hands it is inestimable. However to my mind the vitalizing feature of the shops is their greatest service, for it applies to every case employed. The men are busy and consequently happy. They are interested and so kept keen, active, and prevented from getting slack. This in prolonged cases is really almost half the battle won, for the surgeon, so he must be appreciative of the help so given him. The third feature of the shops is purely reconstructive, in that they offer an opportunity to the man deprived of or handicapped in his own trade by disability, to learn a new and oftentimes better trade which he is able to carry on.

The above applies only to the upcases, and consequently we must sharply distinguish between these and the bed cases as regards time. Time spent in bed is very devitalizing, despite all the efforts made at present to stimulate interest in the bedside occupations of embroidery, knitting, etc. These help, but since they are not naturally congenial occupations for a man they fall far short of doing the good that carpentry, iron or leather working, etc., do. Also, being largely feminine in character, they have the psychological effect of making the man feel hopelessly disabled as a *man*, and this is bad. We must keep up the patient's interest in the outside world that he knows, and this can only be done by personal attention. Each case should be made to feel right at the beginning of treatment that a special person is taking an interest in him, from the social and economic point of view as well as the purely physical. He feels oftentimes, perhaps rightly, that the surgeon or sister is not the one for this. He should have someone else with whom to talk over at length the special problems of his life and home, and who can give advice as to the future and show him how to help keep himself keen and alive even though confined to bed. A social service worker would find this a congenial task, and could be of inestimable help to the surgeon, in presenting to him sidelights on the patient's general situation and problems which might otherwise escape his notice. This need has been recently supplied in British Military Reconstruction Hospitals in the person of an Education Officer, who will be able to do much to keep the patient in touch with his world and to supply congenial bed occupation and appropriate reading matter. Thus the man will have no time to fall into a rut of inactivity of mind as well as body but every possible moment will be utilised, either in refitting him for return to his former place in life, or, if this is barred, by starting him on

his road to a new and perhaps a better station. We must establish a liaison between the patient, the surgeon, and the outer world to get the best results of treatment for bed cases. The ideal of reconstruction is to return the patient to a work-a-day world as fit as possible to meet its requirements. This we cannot do by making our reconstruction hospital a cloister, but by modelling the patient's life in hospital as nearly as possible on his life outside.

C. These are the general lines by which we can minimize the value of the Time Element, but let us look somewhat more closely at the possibilities offered for this in the various types of reconstruction.

(1) *Military*. This comes first, as the largest group at the present time. It is the duty and privilege of a grateful nation to reconstruct its wounded soldiers as far as it can. Also it is sound economy to restore men and cut the pension bills, at the same time increasing the economic value of the citizen. Consequently, we who are in khaki are fortunate in not having to look at time in the light of finance. It is very fair both for soldier and surgeon. The result is, however, that both surgeon and patient must guard more strongly against hospitalization. We must no more allow the deserving wounded soldier to be hospitalized by over enthusiastic reconstruction than the poor to be pauperized by over benevolent charity.

We now have splendid workshops, but much more could be done to improve the effectiveness of these. The Medical Officer could and should keep more closely in touch with the workshops, instead of just vaguely telling his patient to report there for work. The old army habit of "swinging the lead" is strong even in the wounded soldier and sometimes the man "messes about" in the shops, rather than really works. This tendency can be counteracted best by personal interest and supervision combined with discipline tactfully maintained by the N. C. O. and instructors. Our ideals are high, but we feel that it is practicable to get still more good out of the shops than we do now.

Then as to the bed cases we fall down rather badly at present and the hospital staff are too overtaxed with care and nursing to have time to help much. May I suggest that this is a big opportunity for the Y. M. C. A. and kindred auxiliary services to do good constructive work. They have a personnel of trained workers, teachers, lecturers, etc., who could do much to brighten the

lives of the bed cases and revive their interest in things outside the hospital and their illness. A closer co-operation by the Ministry of Labour or Labor Organizations in helping us to refit men and advising them authoritatively as to opportunities open to them, would be of real value.

(2) *Industrial.* Industry is in a much more difficult position than the State for two reasons. (1) The number of injured is smaller, so that elaborate staff and equipment is not practical. (2) Expense of maintaining men in hospital for long periods is too great. Industrial Insurance has done much to encourage reconstruction, and at present many of the larger corporations have grasped the idea, but the shorter-sighted policy still frequently persists. Reconstruction may seem expensive, but if a good economy to the State why not to the corporation? It lessens damages, increases good-will, decreases pensions and makes it possible to re-employ the man in some other capacity. More careful consideration must be given to the Time Element in Industrial Reconstruction than in Military, for its economic soundness must be clearly established before the procedure is undertaken. The surgeon cannot indulge in "good surgery" at the expense of either employee or employer.

I should like to suggest that time is best saved by limiting in-patient treatment as much as possible, and by having the corporation supply a counterpart to the Military Curative workshops by re-employing the man at part time in some job which he can carry on but which will leave him time to pursue the later stages of treatment. To do this there must be complete co-operation between the surgeon and the administration, but as its results will be beneficial both surgically and economically, this ought to be possible and practical.

(3) *Civil.* This is perhaps the most difficult of all. The average civil hospital fights shy of prolonged cases as occupying valuable bed accommodation. The result of this has been that children with orthopaedic troubles are cared for in special hospitals maintained by State or charity. The same must be true of the reconstructive cases. It is an economic asset to the State to have its cripples rehabilitated as far as possible, and this work should have ample State support. In the near future when various Military Reconstruction Hospitals have completed their function, there will be a wonderful opportunity for the State to acquire excellently

equipped plants for carrying on the same work for the civil injuries. This should not be overlooked, for with the spread of the knowledge of the possibilities of reconstruction the civilian who is injured is not going to be content with a half-way patching up.

The same valuation of time applies to civil as well as industrial and military patients, and the same remedies for the dangers of hospitalization are possible. Employment while in hospital is essential here too, and the system of workshops now in force should be applied later. These will be expensive in one sense, but in another sense they should be economical, for they are productive not only of useful articles, but also of improvement in the patients, and they certainly do decrease the length of treatment required. A well organized social service to meet the problem of the bed cases, and to act as liaison for all in putting them in suitable position on discharge is most urgently needed. It could work along the same lines as the "follow up" work in large tuberculosis clinics. In any case there must be no more sitting about the ward in dressing gowns and slippers in the reconstruction hospitals, large or small, civil, industrial or military.

Conclusions.

(1) Time is necessary for conservatism and reconstruction.

(2) Time is valuable to the patient in many ways, to the State or employer as a financial consideration, and therefore cannot be invested without adequate return improvement.

(3) Time spent in prolonged treatment is dangerous to the patient.

(4) Therefore improvement must be greater, the greater the time involved.

(5) The dangers of time must be minimized by:

- (a) Reduction to a minimum of confinement to bed.
- (b) Keeping the patient in touch with the world of his normal life even though he is in bed, through personal interest and appropriate occupation, reading, lectures, etc. Maintenance of mental tone throughout course in hospital.
- (c) Adequate employment in workshops for all up cases.
- (d) Re-education and vocational training in certain cases.

Correspondence

To the Editor of The Journal of Orthopedic Surgery:

Dr. Kleinberg's article on tuberculin in the December number of the Journal deals with a subject of such importance as to deserve critical thought. The author's condemnation of tuberculin as a therapeutic agent is given additional weight by the high standard of his previous publications and his reputation for intellectual honesty. For many, his experience would set the seal on the fate of tuberculin. This tone of finality is my chief objection to Dr. Kleinberg's paper. It is of course perfectly possible that tuberculin in his hands, has been of no value, but his experience does not preclude the possibility of its effectiveness when administered by some one else. In other words, despite Dr. Kleinberg's unfavorable experience, tuberculin therapy ought not to be considered a closed book and I for one am willing to take up the cudgels in its defense.

Until the winter of 1919, I had never seen any encouraging results from its use; in fact, the numerous reports of American, English, French and German observers had all inclined me to distrust it. Last year, however, I saw several cases which compelled me to think of tuberculin seriously. The first was that of a boy of thirteen, whose mother gave me the following history: eight years before the right hip showed evidences of tuberculosis. Despite treatment by a well trained orthopedic surgeon, the disease progressed, sinuses formed and later the right knee became involved. There were, after two years, seven discharging sinuses and the boy gradually wasted away to a living skeleton. His parents, people of wealth, spared no expense in trying to secure aid for the boy and he was seen by several of our best orthopedic surgeons, all of whom gave a poor prognosis. He was constantly, during this time receiving thorough treatment according to our accepted standards. At this critical juncture, five years ago, tuberculin therapy was begun. Within three weeks the boy's appetite had returned and within three months all seven fistulae had closed, never to open again. At the time of my examination I found the boy unusually well developed and entirely without evidences of active tuberculosis.

On the strength of this experience, I selected the severest case of tubercular infection under my care as a suitable test for the tuberculin treatment. The patient, a sixteen-year-old girl, had a left-sided coxitis with three sinuses discharging foul pus, one of these opening into the anus; in addition there were evidences of tubercular peritonitis,—diarrhea, marked abdominal distention due to fluid, and a well developed caput Medusae. The tubercular infection had been present for about five years and the child had been treated at numerous clinics and hospitals without any improvement whatever. After six months of tuberculin-vaccine therapy all sinuses have closed, the abdomen looks almost normal, the child has a good appetite and is able to attend school.

These are but two instances of about thirty which have come under my observation during the past year. It is always a difficult matter to gage the value of a therapeutic agent, since we all tend to fall into the fallacy of post hoc ergo propter hoc, and yet when I consider that in most of these cases the previous treatment, thoroughly and conscientiously given, had been ineffective, whereas after the tuberculin-vaccine treatment had been initiated the improvement occurred within a short time, it seems to me only fair to give credit to this particular agent.

I for one intend to try out tuberculin still further, despite Dr. Kleinberg's condemnation and I hope that some others will do likewise. Its administration is not easy, and one careless mistake is liable to most unpleasant consequences. When there are mixed infections it should invariably be accompanied by the administration of an autogenous vaccine. It is scarcely necessary to add that thorough orthopedic treatment should not be relaxed because of the administration of tuberculin.

For further details of tuberculin treatment, I should refer the reader to Dr. Bonime's book entitled "Tuberculin and Vaccine in Tubercular Infections."

I wish in conclusion to acknowledge my indebtedness to this work, as well as my personal indebtedness to Dr. Bonime, who has helped me by the stimulus of his own enthusiasm and by his constant readiness to advise me and correct my mistakes.

LEO MAYER,

140 West 79th Street, New York City.

To the Editor of the Journal of Orthopedic Surgery:

Doctor Kleinberg's article in your December issue merits attention since it deals with a subject, the literature of which is rather scant. For the very reason that the article is one of the few dealing wih this very important subject and is likely to shape opinion in the minds of your readers, it is of the utmost importance that the statements made should be beyond reproach and without-prejudice.

I do not question Doctor Kleinberg's experience with his own cases in the use of Tuberculin, though to one experienced in the methods devised by Doctor Bonime and used for years at the Polyclinic Hospital, his failures can in a large measure be understood; but when he attacks this method and claims from personal knowledge to have seen no results in the Polyclinic Hospital Tuberculin Dispensary, his statement can not be permitted to reach the profession without being challenged.

My authority for taking this task upon myself lie in two and one-half years' work in the Tuberculin Dispensary of the New York Polyclinic Hospital which has given me a fairly complete knowledge of Doctor Bonime's Combined Method of treatment of Tubercular Bone and Joint diseases, and a good opportunity to estimate the results obtained.

First, I want to point out the fact that the majority of the cases reaching the dispensary were chronic cases which might be called "Orthopedically hopeless," since they had had Orthopedic treatment for years in hospitals and in other clinics without results, and I can state from personal experience during these two and one-half years' that fully 90 per cent of these cases have been cured by Doctor Bonime's Combined Method, and not one have I seen that has not been improved. Now, wherein lies the great gulf of difference between Doctor Kleinberg's statement of his observation at the Polyclinic dispensary and my statement?

Doctor Kleinberg states that Doctor Bonime considers his cases of Bone and Joint Disease cured when they can take pure Tuberculin without reaction. This statement falls short of the absolute truth. Doctor Bonime lays stress in his book and in practice, upon the fact that Tuberculin alone is not sufficient to attain a cure. In addition to the use of Tuberculin to check the progress of the tubercular process, it is necessary to eliminate the mixed infection, which

is always found in open cases with sinus complication, by the use of vaccines and to eliminate the sinuses themselves by the use of Bismuth paste. More particularly does he lay stress on the point that blind pockets are a source of trouble and ultimate failure of cure, unless a counter opening is made and drainage provided, so that Bismuth paste can be used.

Sinuses often persist long after the course of Tuberculin is completed. Very often, in long-standing cases, Nature herself has eliminated the tubercular process and the mixed infection alone is rsponsible for the continued evidence of disease. A sequestrum is usually behind these persistent cases, but the use of Bismuth paste eventually loosens the sequestrum and forces it to the surface. Then healing promptly takes place. The accesory measures to Tuberculin Therapy, therefore, are frequently of equal importance with, if not more important than Tuberculin immunization, and without the combined method these cases can not be cured.

The conception of a cure at the Polyclinic Tuberculin Dispensary includes, not only complete Tuberculin immunity, but also a complete healing of all sinuses and blind pouches as demonstrated by the X-Ray, and absence of recurrence for a period of two years after the completion of the course of treatment. It is insisted upon that the patient return every three months for a period of two years for Tuberculin tests; and only after the eight quarter yearly tests show a continued absence of hypersusceptibility and no evidence of recurrence of the disease, is the patient considered and declared cured. In connection with this point, it is an interesting commentary on Doctor Kleinberg's observations at the Polyclinic Tuberculin Dispensary, that it has been my privilege and opportunity to have given some of these tests to some of the very cases which were under treatment during the time of Doctor Kleinberg's observation and to have pronounced them cured.

Doctor Kleinberg cites one case where the patient reacted with the next regular dose by a temperature of 104° followed by a relapse and ultimately death. Doctor Bonime's method of Tuberculin administration is based on the now well-known principle of slightly increasing dosage somewhat similar to that used in anaphylactic desensitization. If this method is accurately carried out, it is biologically impossible to have no reaction with one dose and a violent one with the next succeeding increase. No method is fool-proof

however, and we find occasionally in our Dispensary, particularly when a new Clinician is put on, that an error is made in the dilutions, or bottle No. 1 is taken up where No. III or IV is intended and so we get a severe reaction. It is more than likely that some such mistake was responsible for the unfortunate experience of the case cited by Doctor Kleinberg.

Dr. Kleinberg's six conclusions contain in them the reasons for Dr. Kleinberg's failure and the evidence that his six months' tutelage under Dr. Bonime had failed to give him a full grasp of Dr. Bonime's methods. He states:

1. Tuberculin does not cure tuberculosis of bones and joints.

This is true in a sense. Tuberculin alone, without the treatment of the mixed infection with vaccines and the sinuses with Bismuth paste, and particularly the care of blind pouches, does not cure the symptom complex of bone and joint disease.

2. In the majority of cases, tuberculin therapy causes no noticeable beneficial influence over the bone or joint lesion.

This is Dr. Kleinberg's statement. Three are many X-Ray records in the files of the Polyclinic Tuberculin Dispensary to prove conclusively otherwise.

3. In a small percentage of the cases there is improvement of the lesion.

An admission which is acceptable, but must be greatly amplified to meet our experience.

4. In some cases there may be distinct aggravation of the disease.

This observation is based on the single case mentioned by Dr. Kleinberg. A suggestive explanation of this case has already been offered.

5. New abscesses may appear during and after completion of the Tuberculin treatment.

True, if blind pockets are not counter-drained and treated. Nature will always force an accumulation of broken down tissue to the surface and expel it, regardless of tuberculin or any other kind of treatment.

6. Relapses occur after apparent improvement.

Which indicates that Tuberculin is a valuable agent in the

treatment of Bone and Joint disease, because, even when used wrongly, there is evidence of some improvement.

In conclusion, the records of the Polyclinic Tuberculin Dispensary are open to any one who wishes to investigate the truth regarding results obtained there in the treatment of bone and joint diseases. Many cases, in all stages of progress are under treatment at the present time (at the West Side Dispensary while the Polyclinic Hospital is still in the hands of the U. S. Army) and can be seen by anyone interested enough to investigate.

Most sincerely yours,

M. L. LANDMAN,
Chief Clinician Under Dr. Bonime.

Current Orthopaedic Literature

THE TREATMENT OF WAR WOUNDS OF THE JOINTS. By Professor Pierre Duval, Paris, France. *Surg., Gynec. and Obst.*, September, 1919, Vol. XXIX, No. 3.

The radical change that has taken place in the surgical treatment of wounds is due to two related causes: First, the fact that the joints resist infection, and second, the adoption of the practice of operating as early as possible in the lines. For practice of late operation and simple drainage, was substituted immediate operation and complete closure of the joint.

Immediate suture is based on the following principles: A war wound is contaminated directly by germs which are carried into the wound by shot and fragments of clothing. Infection developes but the defensive reaction of the synovial membrane is much more efficacious than that of other tissues; the synovial membrane seems to possess a bactericidal power. If a wound is examined bacteriologically a few hours after receipt, the usual bacteria are found in the skin, the muscles and the aponeurosis. The tissues and clothing contain a great number of bacteria. If the bones have been injured the surfaces of the fracture are contaminated and the edges of the torn synovial membrane are also contaminated, but the synovial fluid, the blood and serum are without bacteria. This aseptic state of the synovial membrane persists for a relatively long time—24, 48 and sometimes even 60 hours—before the septic arthritis develops. An appropriate operation permits the excision of all the contaminated tissues including bone tissues, the resection of the contaminated edges of the synovial perforation, the removal of all foreign material—the bearers of infection—that is, when the surgical wound and the joint cavity are aseptic, that complete suture without drainage should be done.

In wounds of the soft parts, in the edges of the perforated synovial membrane, on the shot and fragments of clothing and on the fractured bone surfaces, germs may be present, but the joint fluid is without bacteria.

Total immediate resection must be done only to smooth out very serious injuries of one or both bones of a joint when the injury itself has really accomplished resection.

In war wounds of the joints the utmost must be done to save the limbs. If through misfortune the functional result is bad, a secondary economical resection can be done at a later period.

In 1917 and 1918, the surgical treatment of war wounds of the joints was based on the following principles:

1. Operation as soon as possible.
2. Removal of all foreign substances; total excision of the track of the missile.
3. Careful cleaning of fractured surfaces, complete suture of joint without drainage.
4. Active and immediate mobilization.
5. Preservation of parts to as great an extent as possible, immediate resection being limited to injuries with extensive comminution.

The technic varies with each case according to the location of the wounds of the soft parts. As a general rule there are two methods of procedure: (1) treating the peri-articular wounds first, gradually proceeding to the joint and (2) treating the joint injury first and then treating the peri-articular wounds.

The arthrotomy incision must be ample; for the elbow, external lateral incision, internal lateral and the mid-line posterior incision for the posterior wounds. To expose the joint clearly the author always practiced section of the external lateral ligament which permits opening the elbow-joint widely, jerking the forearm toward the inside. This section formed in this way followed by well executed reconstructive suture dotes not compromise the function of the elbow-joint.

For the knee, two methods are in use: The U arthrotomy with section of the patellar ligament and the unilateral or bilateral arthrotomy.

The U arthrotomy must be reserved for extensive wounds of the bones as well as for posterior and intercondylar wounds, for it alone permits in these cases the right treatment of bone surfaces. For posterior wounds or wounds of the popliteal space with deep seated injury to the condyles or of the back part of the tibia, U arthrotomy alone permits proper treatment of bone injuries. For lateral wounds of the condyles of the femur or the tibia, in lateral wounds of the patella and in simple perforations of the synovial membrane, the large unilateral or bilateral arthrotomy is the method of choice. Transpatellar arthrotomy is not suitable for fresh war wounds of the knee. At the ankle, shoulder and wrist, the incision varies with the size of the wound.

The treatment of limited bone injuries is the capital point of the technique. Limited injuries in which there are fragments of shell are treated by ablation of the foreign bodies and careful cleaning of the joint cavity. Bacteriological observation shows that, after cleaning, the bone tissue is without bacteria.

The bone tissue infiltrated with blood must not be cleaned too vigorously. When one operates at the most opportune time, that is 8 to 12 hours after receipt of injury, the cleaning must be superficial. An important question to decide is whether a bone cavity which continues to bleed more or less should be left open in the joint. When the bone injuries are lateral and at the same time are extra articular or intra-articular, by proper suture of the synovia the cavities are separated from the joint.

When the bone injury is complicated by the presence of fissures more or less extensive the treatment must be the same as for all fractures. After scraping the center of the fracture the fissures must be opened with a lever of any kind so as to scrape the walls of the fissures; then the bone fragments thus displaced must be replaced. If the bone fragments cannot be correctly maintained in place so as to re-establish the joint surface as much as possible, one must resort to nails or screws. This must be done in injuries to the condyles of the femur, tibia and humerus, or of the deep part of the patella.

Once the joint is well cleaned we have a surgical aseptic wound and the operative procedure must be the same as for a closed fracture of a joint.

The most important result to be obtained is the re-establishment of a normal joint outline. Experience has shown that good functional results can be obtained even when there is a partial loss of joint surface if the general outline of the joint surface has been preserved.

The treatment of perforations of the synovial membrane is important. Edges of the synovial aperture usually are bruised, lifeless from traumatism and contaminated by bacteria from the wound. It is necessary to treat them by excision and then by suture.

The treatment of the serious fluid in the joint is most important. The serious liquid must be dried up as completely as possible with dry sponges in all parts, so as to leave neither blood nor fibrinous coagulum.

Up to 1918, before placing the last suture, almost all surgeons poured ether into the joint and rubbed the surface of the bone with a sponge saturated with ether. By degrees this antiseptic treatment has been abandoned and joint surgery has become purely aseptic.

The terminal suture is made layer by layer, preserving as much as possible the ligamentous, fibrous and muscular planes periarticularly. No drainage is used.

War wounds of joints are frequently accompanied by extensive muscular peri-articular destruction. It is most important to repair grave injuries to the important muscles. There are two muscles for which this repair is of first importance—the arm triceps and the high quadriceps extensor.

Active immediate mobilization of joint injuries insure ultimate perfect functional results even in cases of comparatively extensive bone destruction. Twenty-four or even thirty-six hour's after injury joint surgery may be applied.

All injuries to joints must be treated according to these general principles. In the hip only it is thought advisable to do resection directly. At the elbow, wrist, shoulder, knee and ankle, aseptic and highly preservative surgery gives extraordinary results.—*Leo C. Donnelly, Detroit.*

PENETRATING INJURIES OF THE KNEE JOINT. H. C. Mitchell. *Illinois Medical Journal*, 1919 XXXVI, 255.

The author from his experience in railroad and mining surgery, sets forth some good points in surgery of the knee joint. The past five years have given much to our knowledge of knee injuries, and, while previous to this time, a severe infection meant amputation or a stiff knee, we are now able to preserve motion in a large percentage of such cases.

The method of drainage is probably responsible for the good or bad result in most instances. We have learned to avoid the synovial cavity in placing our drains. When drainage is necessary it is best to suture the edge of the synovia to the skin in order to establish an outlet, or to place a drain down to, but not into the synovial cavity.

In past years, as far back as the Civil War, injuries to the knee, especially gun-shot injuries, gave a mortality of 60.6 per cent. In the Spanish War this was reduced to 6.5 per cent, and the Boer War to 4.2 per cent.

The necessity for immediate immobilization in penetrating wounds of the knee is emphasized. A case is reported in which the author was called on to do a complete arthrotomy to extract a nail from a knee joint, which at first partially protruded but had completely disappeared inside the joint during the journey, without immobilization, from the scene of the injury to the hospital.

In cases of small steel fragments passing clear through the joint, or lodging in the lower femur or upper tibia (not in the joint), all that is necessary is to immobilize completely for a week or ten days. Accumulation of fluid should be aspirated and examined for organisms.

If the foreign body has lodged in the joint it must be removed. The operation should be preceded by accurate localization with the X ray. The surgeon should never grope blindly for a foreign body in the knee joint. A good practice to follow is to "see well what he does and do well what he sees."

Penetrating wounds with infection and extensive joint fracture require extension of the leg to keep the joint surfaces well separated to establish adequate drainage. If either condyle is torn away it is better to excise the joint.

Amputation is indicated in cases of "extensive laceration of the soft parts and injury of the blood vessels, or beginning gas gangrene with extensive fracture accompanied by severe infection."—*William Arthur Clark.*

THE CONTRIBUTION OF THE WAR TO THE SURGERY OF THE KNEE-JOINT. By Burton James Lee, M. D., of New York. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

Willems' treatment of a wound of the knee-joint may be briefly outlined as follows:

1. Accurate foreign-body localization.

2. Careful debridement of all soiled and devitalized soft tissues and soiled bone.

3. Removal of all loose bone fragments and foreign bodies.

4. Irrigation of the joint with saline.

5. Filling of the joint with ether.

6. Primary closure of the joint by suture, usually including the skin. With considerable injury to knee or muscle, it is wiser to close the joint capsule, but leave the skin and muscle unsutured.

7. Early and frequently repeated active motion of the knee, no splint being applied, save with massive bone injury. This mobilization is begun upon the second day and is continued at two- or three-hour intervals. The patient is up and about the ward, with crutch support, on the fourth day, and is encouraged to walk without any support by the tenth day.

The treatment of infected knee-joints was outlined by Willems in the following manner: Opening of the joint through sutured wounds or by lateral incision, no drains of any kind being introduced. Active mobilization was continued, as with the non-septic knees, the patient being awakened at two-hour intervals, night and day, and encouraged to move the joint. As soon as practicable the man was compelled to get up out of bed, and to use the leg in as normal a manner as possible.

The author was very much impressed by the careful painstaking work of Dr. Delroz at La Panne with the joint cases there. The entire morning was spent on rounds, and each patient with a joint injury was encouraged to move his joint under Dr. Delrez' personal supervision. The operative technic carried out on these cases was finished, a clean dissection being made with the

smallest amount of traumatism possible. The work was never hurried, and when the operation upon the joint was finished, one had the conviction that a careful debridement of all soiled tissues had been accomplished.—*Leo C. Donnelly, Detroit.*

POCKETING OPERATIONS AND OTHER SKIN AND FAT TRANSFERS. By John E. Cannaday, M. D., Charleston, W. Va. Maj., M. C., Assistant Chief of Surgical Service, Base Hospital, Camp Sherman; and Leslie S. Brookhart, M. D., Cleveland, Ohio. Capt., M. C., Assistant Chief, Surgical Service, Base Hospital, Camp Sherman. *Annals of Surgery*, Vol. LXX, October, 1919, No. 4.

The confinement of the operated part in a comparatively fixed position is tedious but not painful. Some of the indications for the transfer of skin and subcutaneous fat are: For the purpose of filling deep depressions caused by the loss of portions of the bony and soft structures of the body. The restoration of the soft parts preliminary to certain operative procedures on bone and tendon. For the purpose replacing large deforming scars of low vitality. To cover large surfaces left by the excision of granulating areas, or by the debridement of bone sinuses. To round out and put in proper condition for weight-bearing, painful and unhealed stumps. To cover recently denuded bone, such as the fingers after severe lacerating and crushing injuries. The technic is simple but must be exact. Flaps for the face, neck and nose are usually taken from the upper arm. For the eye-lids the skin from between the fingers is well suited. For the hand, fingers, forearm and wrist, transfers and made preferably in most cases from the abdominal wall, but also from the chest, gluteal region, outside, front, or inner side of thigh and from the opposite arm. For the feet and legs, transplants are taken from the calf or thigh of the opposite side. The posterior surface of the thigh is a suitable place from which to take a flap for the leg of the opposite side.

The flaps are cut either single- or double-ended, as the exigencies of the case may demand. They are cut about one-third larger than the actual measurements would seem to call for, so as to allow for shrinkage and to avoid tension. The flaps are cut with a generous layer of underlying fat, which carries a good blood supply as well as giving full measure of protection to tendons, nerves or other important structures lying underneath. If a sufficient thickness of fat is used to make the implant rise above the level of the surrounding tissues, the excess of fat will ultimately be absorbed, as nature's constant effort is to restore the natural contour of the body. During the process of healing in place, all skin transplants thicken slightly, but the excess of tissue disappears with use and time.

The suture of the skin edges of the transplant to those of its bed must be done with care and accuracy. The sutures should be inserted very near the skin edges and should be tied with the minimum amount of tension.

In a case of double-ended flaps with the arm projecting through the opening under the same, the skin surfaces of the arm will tend to come in to more or less intimate contact with the chest wall and will interfere with the toilet of the wound of the abdominal wall, making it difficult to keep the suture line dry and clean. These difficulties can be overcome to a con-

siderable degree by the following expedients: The arm may be slightly separated from contact with the body by insertion of rolls of gauze at various points, allowing a circulation of air about the wound and avoiding sweating and maceration of tissues. A bridge made of wire is used to accomplish the same result as the rolls of gauze. No gauze or other conventional dressing materials are applied to the operative wound incident to these plastic procedures. Gauze would only serve by the foreign body reaction to cause irritation and exudation of serum from the raw surface at the base of the flap. The skin surfaces are carefully cleansed with alcohol, ether or Carrel-Dakin solution, several times a day. Wounds are frequently exposed to direct sunlight or to electric light in cold or cloudy weather.

The length of time required for these flaps to develop a new blood supply sufficient to maintain viability after the ends of transplants are detached from the body varies considerably for many reasons. Some surgeons have assumed that ten days is a sufficient length of time, others say fifteen days, but personally we have found it better in most cases to wait for about three weeks in order to insure complete success. If the time has been too short there is apt to be some loss of tissue by necrosis at the severed edges. When a double-ended flap has been used, it is often advantageous to detach one end a few days previous to the other in order that the ensuing circulatory disturbances may not be too abruptly brought about.

After both ends of the transplant have been detached, they are cut to correct shape, the raw edges slightly undermined and sutured in place. In order to secure primary union it is highly important to exercise all granulation tissue about the flap edges previous to suturing. The small raw surface at the base of the flap on the body is treated in a similar fashion. The dry treatment with exposure to electric light or sunlight is continued until healing has taken place.

Conclusions

That skin and fat transplants are valuable for the elimination of cicatricial tissues with their coincident deformities.

That by their use superficial sinuses in bony and soft tissues can be eliminated and depressions can be filled.

That accuracy of technic is essential to success in this line of work.

That the suture line must be kept dry. That the absence of dressings and some form of mechanical support that will prevent the skin surfaces of the arm and body from coming in too close contact are valuable aids.

That months of time are saved the patient.—*Leo C. Donnelly, Detroit.*

Intramedullary Beef-Bone Splints in Fractures of Long Bones. By Edwin W. Ryerson, M. D., Maj., M. C., U. S. Army, Chicago. *The Journal of the American Medical Association.* Vol. 73, No. 18, November 1, 1919.

In fresh fractures and in reasonably young persons, heterogenous bone pegs may be used with safety and with the assurance that bone growth will not be inhibited. Beef-bone and ivory nails, screws and intramedullary grafts have been used by a small number of operators.

Beef-bone splints of various sizes are cut from the long bones of the slaughtered cattle. It is possible to procure from a butchers shop pieces of the tibia or femur 5 or 6 inches long, and these are split with a saw into suitable sizes. They are then turned into a lathe or filed with a wood-workers rasp or run through a dowel cutter so as to be round or nearly round. Those for use in the femur should be about 5 inches long by three-fourths inch wide, for adults, and several smaller sizes should be ready in case the medullary canal should be unusually small, or for use in children. Splints for the humerus should be three eighths inch wide, and those for the radius and ulna, one-fourth to fixe-sixteenths, and three inches long. The ends of the splints are rounded off, and a hole is bored through near one end like the eye of a needle. These splints are then sterilized by fractional sterilization, and kept in containers. When it is desired to use them, they are boiled with the instruments.

The technic of their use is as follows:

The fracture is exposed with as little removal of periosteum as possible. The beef-bone splint is pushed into the longer fragment until it is completely within the bone, a long piece of heavy chromic catgut having been previously threaded into the eye of the splint. This double thread hangs out from the end of the bone. An eighth-inch drill is now used to bore a hole in the other fragment, distant from the fracture about half the length of the splint. The hole slants a little toward the fracture end. A piece of wire, bent at the middle to form a sort of probe, is now passed into the hole and out through the fractured end of the bone. The two ends of the catgut cord are then threaded into the wire probe, and the wire is pulled back through the hole, bringing the catgut with it. The over-riding ends of the fracture are now reduced, either by a Murphy bone skid or by leverage or traction, the catgut cords being tightened at the same time so they will not become caught or pinched. When the bones are in position, the catgut cords are pulled on, and the splint will glide half way from one fragment into the other, so that it will be at exactly the proper point.

The catgut can be threaded into a needle, and sewed into the periosteum or muscle at its point of exit, which will secure the splint so that it will not slide out of position up or down the medullary canal.

Such a splint cannot fit the canal very tightly and it is not necessary that it should, provided that it is prevented from sliding out of place, and this is accomplished by the catgut.

THE PATHOLOGY AND TREATMENT OF STIFF KNEE IN RELATION TO COMPOUND FRACTURE OF THE FEMUR. By Capt. C. Beresford Alexander, R. A. M. C. (T.) *The British Medical Journal*, No. 3063, September 13, 1919.

Fibrous or bony ankylosis of the knee frequently follows compound fracture of the femur when the fracture is into the joint or when there has been prolonged suppuration near the joint.

There is another class of "stiff knee" which follows compound fracture of the shaft of the femur in which the limitation of flexion is not due to

articular so much as to periarticular and muscular changes. This is the type which yields very satisfactory results with careful treatment. Stiff knee after compound fracture of the femur may be due to articular, periarticular, or muscular causes. It is chiefly the changes in the quadriceps which cause stiffness.

In a typical example a markedly wasted and scaphoid quadriceps exists. On passive flexion of the knee, considerable pain is generally caused by periarticular adhesions, but if these are absent, a very much shortened quadriceps prevents flexion for more than a few degrees. This means that the normal function of extensibility and contractibility are absent; that in parts dense scar has replaced the muscle tissue; and that there are scars of healed sinuses reaching down to bone. This state of affairs has resulted from the original injury, the persistence of sepsis, and prolonged disuse.

Histologically the picture varies with the position from which the sections are taken. Those near the septic focus show absolute replacement of muscular tissue by scar, while other sections show decreasing amounts of scar. Soagulated fibrin binds down the muscle fibres.

Throughout the muscle there is considerable shortening of individual muscle fibres, which, in addition to showing marked contraction in size, are in a state of partial degeneration, and as a result of prolonged disuse have "forgotten" how to function. This condition is that of typical disuse—atrophy.

There is a certain degree of regeneration going on as a result of proliferation of sarcolemma nuclei, and muscle cell budding and splitting. The survival of the young muscle cells thus formed depends upon the degree of encouragement they receive to function; otherwise they run the risk of destruction before they reach maturity, either by disuse-atrophy or by condensation of the recently formed scar tissue. Their failure to survive only increases the amount of fibrous tissue formation.

During the treatment of compound fracture of the femur there are all the necessary conditions for the formation of fibrous tissue in muscle—namely, trauma, sepsis, and prolonged disuse. In the neighborhood of the fracture and about each sinus, the muscle is riveted to the bone by dense scar. With a normal joint such a shortened muscle forms a considerable obstacle to flexion of the knee. Similar charges are found about the tendon sheaths and in tendons and ligaments around the knee-joint due to the same causes.

Treatment should be first prophylactic, by chemical sterilization, removal of all sequestra, and early secondary closure of wound when possible. Secondly, any scarring which binds the muscle to the bone and all intramuscular and periarticular adhesions must be broken down. Thirdly, the normal functions of contractibility and extensibility must be restored and growth of young muscle cells encouraged.

As soon as the condition of the wounds permit the quadriceps should be treated by graduated contraction by means of the Bristow faradic coil. This loosens intramuscular and periarticular adhesions and restores tone to the muscle, which begins to increase in size.—*Leo C. Donnelly, Detroit.*

FRACTURE OF THE FEMUR. THE APPLICATION OF WAR LESSONS TO CIVIL PRACTICE. By Carlton R. Metcalf, M. D., Concord, N. H. Lieut.-Col. M. C., U. S. A., in charge of Base Hospital 88, Savenay, France. *Ann. of Surg.*, Vol. LXX, Nov., 1919, No. 5.

Fractures of the femur may be arbitrarily divided into four groups: (1) Intracapsular; (2) Upper third; (3) middle third; (4) lower third. In these several groups we find specific deformities which must be counteracted.

1. Intracapsular.—In war clinics one rarely sees impacted fracture of the hip. We have dealt with loose fractures in healthy young adults.

Deformity.—Upward dislocation of the femur. In neglected lesions there has been persistent adduction of the thigh. To counteract: Thomas splint. Traction, with thigh in abduction to 35 degrees and in flexion to 30 degrees. In this position the foot naturally rotates outward slightly and should be so held. After overriding has been corrected, immobilize in a plaster spica. This is analogous to Whitman's treatment for impacted fracture of the hip.

2. Upper third. (a) Fracture just Above the Small Trochanter.

Deformity.—Upper fragment abducted. (Glutei pulling on great trochanter.) (2) Upper fragment not flexed. (Insertion of iliopsoas is below site of fracture.) (3) Lower fragment drawn upward, inward and slightly forward. (Composite effect of extensors, adductors and flexors on thigh.)

To counteract: Straight traction in abduction.

(b) Fracture Just Below the Small Trochanter.—Common type of fracture.

Deformity.—Upper fragment abducted. (Glutei pulling on great trochanter.) (2) Upper fragment flexed. (Illio-psoas.) (3) Upper fragment rotated outward. (External rotator group—obturators, pyriformis, germilli and quadratus —more than counteract anterior portions of gluteus medius and minimus, tensor fasciae femoris and ilio-femoral ligament.) (4) Lower fragment drawn upward and inward. (Composite effect of extensors, adductors and flexors of thigh.)

To counteract: Thomas splint. Traction, with thigh in flexion to 30 degrees and in abduction (about 35 degrees) until the lower fragment has been brought into alignment with the upper. Flex knee 25 degrees. Support the lower fragment posteriorly to prevent subluxation. Utilize "screw pads." They are attached to longitudinal rods of the Thomas splint. If outward rotation is not overcome by the vertical pressure of the ring of the Thomas splint, it can be compensated by rotating, to a like degree, the lower fragment.

(c) Oblique Fracture, Downward and Inward, Below the Small Trochanter. Deformity.—Upper fragment flexed but adducted (in distinction to the abduction of the two preceding types) by the pull of the adductor muscles inserted near the small trochanter. To counteract: Thomas splint. Traction, with thigh flexed and adducted to bring the lower fragment into alignment with the upper fragment.

3. Middle Third. Deformity.—(1) Lower fragment drawn upward. (2) Lower fragment tilted slightly backwards. (Gastrocnemius.) To counteract: Thomas splint. Traction. Correct subluxation by posterior support. Utilize "screw pads" for insistent pressure on either side of the thigh.

4. Lower Third. Deformity.—(1) Lower fragment titled backward. (Gastrocnemius.) (2) Lower fragment slightly adducted and slightly rotated outward. (Adductor magnus.)

To counteract: Traction, with the knee flexed from 35 to 90 degrees. It is necessary to have firm support behind the lower fragment, especially if traction is made by some means other than calipers.

The deformities which one must guard against particularly are four in number:

1. Excessive shortening, because of inadequate traction or poor position or both. A good result entails shortening of less than one inch.

2. Subluxation of the shaft, because of inadequate posterior support.

3. Rotation of the lower fragment on the upper, with the result that a patient ultimately toes out or toes in.

4. Abduction of the upper fragment.

The Thomas splint serves as a foundation stone in several methods of treating fractures of the femur. Whichever method one employs, a few fundamental facts must be observed:

1. The size of the ring of the splint is not a vital factor, so long as it be large enough. A snugly fitting ring is preferable but not essential.

2. The posterior portion of the ring should impinge against the tuber ischii.

3. This intimate, unchanging contact can be procured only when there is a vertical pull on the ring.

4. The distal end of the splint must be elevated.

5. The Thomas splint should be bent in slight flexion at the knee—ordinarily to about 25 degrees from a straight angle. This amount of flexion is to be increased in fractures of the lower third of the femur.

6. A foot-piece may be erected to hold the foot at a right angle.

7. Posterior support is had by double strips of flannel bandage running behind the limb, from one side-rod to the other.

8. Traction is procured by weight and pulley. The initial weight should be the maximum.

9. If pull and proper position do not suffice to secure alignment, employ "screw pads."

10. Leabe the knee free and uncovered. Massage of the joint minimizes the probability of final knee-joint disability.

11. Examine the splint daily. Adjust the flannel slings, check traction and position. Measure the length twice a week, but do not disturb the fracture needlessly. Check alignment and callus formation with x-ray pictures; a bedside machine is of great help.

12. Watch the perineum. Soap the ring before applying the splint, and soap it daily thereafter. Pearson passes between the ring and the skin a prepared strip of calico, boiled in soft soap. Rub the patient's back with alcohol.

13. Teach a patient some occupational work—knitting, basket-weaving, painting or the like—to busy him during his protracted confinement.—*Leo C. Donnelly, Detroit.*

Flat Foot and Its Prevention. By Edward H. Bradford, M. D. *Journal of Industrial Hygiene*, November, 1919.

There are four important facts, which are often overlooked, to be remembered in considering the working capacity of the feet:

1. The spreading power of the toes and the front of the foot.
2. The strength of the toe clutch upon the weight-bearing surface.
3. The greater height of the inner side of the foot, as compared to the outer side, from the ball of the great toe to the ankle while the foot is in the habitual non-weight-bearing position.
4. The degree of the mid-ankle motion to the inner side. Shoes made for and worn during working hours, without regard to these facts hamper the functions of the foot and impair its normal service.

A large majority of the cases that are unable to engage in any ordinary occupation without foot distress are due to improper foot-wear. This statement does not include the small group of congenitally or paralytically deformed feet. There is no doubt that the shoes commonly worn are the chief cause of foot weakness. The foot is shaped to the shoe more than the shoe to the foot.

The result of the physical examination of the first million draft recruits in this country showed the overwhelming predominance of flat foot as a physical defect. The condition was found in the ratio of 177.45 per 1,000.

Examination of American shoe lasts shows a common disregard of the evident fact that the inner side of the front of the foot is much higher than the outer side when the foot is placed in the strong weight-bearing position. Shoes that are made from lasts which are flat in front, exert pressure on the inner side of the foot, forcing it down to a lower level. To reach this lower level the front of the foot is turned out twisting at the astragalo-scaphoid and calcaneo-cuboid articulations, and the inner arch is pulled in and down. The American last is often not only too flattened in front, i. e., back of the ball of the foot, but also is even concave. In shoes made from such lasts, even if the sole of the shoe is wide, free action of the toes and the toe grip, important in heavy weight-bearing or in fast walking, are seriously hampered, and in anything except an over-loose shoe are made practically impossible.

These defects in the shapes of lasts although important, have received much less attention than they deserve and for this reason they are referred to in this article in preference to other defects already noted by medical writers. A disregard of the above-mentioned facts impaired the usefulness of the army shoe in the last war. Owing to the fact that the army shoe was too greatly flattened at the front to be serviceable, it was necessary to supply unduly long and loose shoes. When this was not done, foot strain was apt to follow.

Reliance is often placed upon arch supporters to help relieve the strain of the superimposed body weight. The stiffened in-soles sold by the shoe dealers for this purpose are useless. What is needed is not a support to hold up the arch of the foot, and thus prevent its flattening, but something which holds the foot from falling, under the body weight, too far to the inside of the mid-line of the leg and foot. Plates constructed to do this effectively are heavy. Moreover, they do not serve their purpose except in the standing

position with the weight falling directly upon them and are not of use in other phases of gait. If continuously used they cause by their pressure, as do splints applied to the limb, weakening of the muscles, and are therefore eventually injurious.

There is no question that the deformity of static flat foot is due to faulty foot-wear and the need of reform in the shaping of shoes is clear. It is necessary that the general public be made aware of the fact that ill-designed footwear cripples the feet, and that the manufacturers be convinced of the necessity of improvment in the styles of shoes and informed as to the ways in which this improvement can be accomplished.—*Mark Cohn, M. D., New York.*

Personal Mention

A letter has been received from Colonel Elliott G. Brackett dated Paris, December 1. He refers briefly to his recent study of conditions in the Balkans and other parts of Europe. Dr. Brackett will return to the United States during January.

Dr. John P. Sprague has returned from service and is at 1308 Michigan Boulevard Building, Chicago. His practice is limited to orthopedic surgery and corrective gymnastics.

Dr. Lionel D. Prince has resumed practice with offices in the Flood Building, San Francisco. Practice limited to orthopedic surgery.

Dr. Wilton H. Robinson announces his return to Pittsburgh with offices at 6075 Jenkins Arcade Building. Practice limited to orthopedic surgery.

The Jackson County Medical Society members have decided to give a banquet in honor of the fiftieth anniversary of the entrance into practice of Dr. Jefferson D. Griffith, Kansas City. The banquet will be held about March 4, 1920.

Dr. J. C. Brugman announces to the profession the opening of offices in connection with Dr. H. A. Shaw and associates, Suite 3050 Arcade Building, Seattle, Washington. Practice limited to orthopedic and bone surgery.

By the will of Henry C. Frick, the residuary estate is to be divided into 100 shares valued at about half a million dollars each. The Children's Hospital of Pittsburgh will receive one share.

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The Journal *of* Orthopaedic Surgery

THE ARTHRITIDES AND FOCAL INFECTION
A CLINICAL CONTRIBUTION

BY VIRGIL P. GIBNEY, M. D., L.L.D., F. A. C. S.

In selecting the term Arthritides I had in mind arthritis involving one or more joints articular or periarticular in children as well as in adults. The bone lesions osteo-myelitic or periosteal regarded as tuberculous or malignant are not included in this communication.

A few years ago while making the rounds of Mercy Hospital with that distinguished surgeon and authority on bone and joint diseases, the late Dr. John B. Murphy, he made this remark: "Doctor the day is not far distant when the terms *rheumatism* and *gout* will no longer be employed in our nomenclature." It seemed a bold statement to make but coming from so experienced a clinician it commanded my respect. I am well aware that laboratory workers and internists still maintain that *rheumatism* and *gout* are distinct entities and are amenable to prompt relief and often cure, by specific medication. When, however, the acute stage merges into the chronic and one or more joints remain not only greatly impaired in function but persistently painful even though the laboratory still reports the presence of the strains of rheumatism, we begin a search for a focus of infection and usually find one in the oral cavity, the sinuses, the intestinal tract (which includes the gall bladder) or in the genitor urinary organs. Specialists develop so rapidly nowadays that I must not omit those parts of the anatomy studied by the proctologist to say nothing of the gynæcologist and the neurologist. The neurologist and the orthopaedic surgeon rarely find primary foci of infection in the tissues and regions over which they claim proprietary ownership.

We find as a rule the diseases and disabilities coming under our observation carried by foci in organs neglected or overlooked by fellow practitioners, including the dentist. I purposely refrain from even mentioning the various pathies in this discussion.

The term *subacute* and *chronic rheumatism* should, in my opinion, occupy a small place in our nosology, and yet there is nothing so satisfying to the average patient affected with a chronic arthritis of one or more joints than an affirmative reply to his question: "Doctor, dont' you think I am suffering from *rheumatism?*" He has a disease for which he is no way responsible and one which he may have inherited from some ancestor, more or less remote.

The laboratory has taught us that foci of infection in any part of the anatomy may contain bacteria that find a pathway into the blood current and have a special affinity for organs whose resistence may be lowered at a given time.

Take for example, a joint. An abscess at the root of a tooth with streptococci viridans, a tonsil whose crypts contain not only streptococci but other micro-organisms delights in pouring into the blood current these colonies which find lodgment in or around a joint whose hyperaemia has been brought about by a trauma however inconsequential. "Bruised my knee but didn't pay any attention to it so slight was it, was all right next day and went about as usual, but a few days later pain was very acute." Such expressions are very common in my interviews with patients and I am sure must be common in the experience of all whose habit it is to look into the cause with painstaking insistency.

My routine is to go carefully into the history of the case as the patient presents at the first visit, get the family history, making notes of every important item bearing on a possible cause. The teeth and tonsils are first examined and, if suspected, a date made for a radiograph and a laryngological report. Failing to find a focus in the oral cavity, the abdomen is subjected to a physical examination which includes the rectum and genitalia. A search is made for any of the signs of a gonococcus or a leutic infection. A Wassermann test is often made, especially if a doubt arises. If, in the interview, a history of intestinal-toxaemia is found or suspected—stools in sterile retainers are sent to the laboratory for an examination and report. This report, to be of

any value, should, in my opinion, conform clearly to this sample taken from the record of Case 1 reported in this communication:

"Findings show a strongly alkaline, extremely toxic stool with a large amount of blood coloring matter. The bacteria are almost totally Gram positive. The methods of treatment in this type of case, in which we have had good results, are enclosed herewith."

So much for a full record of the case at the outset.

The notes made from time to time during the course of treatment may or may not prove as interesting, but demand a faithful record if the contribution is to be of any value to the profession.

The following cases are reported, not in detail, but in abstract sufficiently full to give one a clear idea of the methods employed to obtain relief.

CASE I. (No. 13269-A.) A lady about 50 years of age unmarried came under my care November 7, 1916, for an *Arthritis of the right knee.* Her physical condition seemed excellent but the family history brought out T. B. There was nothing in the personal history except a chronic laryngitis for which she had been treated by a prominent laryngologist. Prior, however, to September 1st of this year she was in good health and quite active. A "sore throat" lasting about a week at this time and during the attack was complicated by pain in the cervical spine and shoulders. Two or three weeks later the above symptoms having disappeared, her right knee "gave out" while taking a walk and the pain was "like a toothache." A physician of high repute treated her for *rheumatism* but a consultant diagnosed a *traumatic synovitis*. Relief not following, a medical friend advised an X-ray of the teeth. The films revealed severe pyorrhoea and apical abscesses (granulomata) in several teeth. My examination recorded a moderate synovial disturbance, flexion not beyond 90°, slight lameness and much pain on going up and down stairs. I regarded the case as one of *infectious arthritis* and advised seeing a dentist, a recognized authority on pyorrhoea. The knee was strapped with adhesive plaster and use of the limb in moderation allowed.

November 10. A letter from the dentist was received confirming the radiographic findings and stating "the condition of her mouth is such as could explain her arthritic symptoms."

November 13th. The laryngologist reports streptoccus haemolyticus and pus in tonsils and while he "does not ordinarily advise removal in a woman of her age he thinks they should come out.

December 18th. The tonsils have been removed and a *few days later* the left knee was involved—she is usually worse "after active treatment of the throat" and her laryngologist says the tonsillectomy would aggravate the general symptoms.

December 20th.. Yesterday the left wrist was inflamed and very painful—aspirin in large doses gave some relief. She attributes the invasion of these joints (the left knee and wrist) to the *tonsillectomy.*

In the management of the case I am assisted by a well known internal medicine consultant. The urine is free from albumen, sugar, acetone and indican but contains hyalyine and granular casts and has a specific gravity of 1024. Blood examination gives a negative Wassermann. Two septic teeth have been extracted and active treatment of the pyorrhoea begun.

From this time on the joints were treated by counter irritation, strapping with adhesive plaster, protective apparatus, drugs, including mercury and the iodides, massage and a change of air to the country for the summer with a perceptible amount of relief.

November 27, 1917. Further counsel was sought and a distinguished orthopaedic surgeon from the Surgeon General's office went over the case with a view to arthrotomy or arthroplasty but on studying the laboratory findings as shown on page 3 of this report we unanimously decided against any operative procedure. The treatment of the intestinal toxaemia, consisting of low irrigations containing sugar of milk followed in a few days, by irrigations with live colon bacilli, was further carried out by a nurse trained in this method. By the end of March, 1918, the stools showed "reaction faintly alkaline, indol plus XX, skatol plus X, B. Coli present, few Gram positive types. The findings are approximately within normal limits."

Notes made in December, 1917, and in January, 1918, recorded a gradual improvement in the arthritic signs and symptoms, but in February an exacerbation coming on, the strong galvanic current 10 minutes daily was employed, hoping to bring about resolution of the exudates about the joints and thus improve the range of motion.

March 15, 1918. The counter irritation and the galvanic current have failed to restore function and a course of baking in the Turnauer apparatus is begun. She is able to walk by aid of crutches but has found the protective apparatus (Campbell braces) a handicap. The general symptoms are less marked but the stiffness and pain on use of joints are very discouraging. A psychic element believed to be induced by domestic and home conditions hard to avoid has all along complicated the physical condition.

During the summer of 1918 she is under treatment at Watkins Glen and the non-specific proteins of alfalfa and millet seed are employed with apparent benefit. She returns in the fall a little more helpful, less pain but no decided increase in function of the joints. The proteins are continued for a while but are abandoned because of abscesses at the points of insertion of the needle.

During the autumn I see the patient occasionally as she is under the care of a surgeon well known for his aseptic tecnic and he assures me that the abscesses were not caused by infection from the needle.

The winter was spent in Tucson, Arizona, but the traumata induced by the railroad trip brought on an exacerbation of the joint symptoms and the air of Arizona failed to bring about any improvement.

From a letter under date of June 14, 1919, a few quotations give the result:

"I wish I had some good news to communicate but I haven't. After four months of climate, a really glorious one, with only three days of rain in the time, I return not in quite so good shape as when I started. I am better in general health but so much more stiff that I am longing for those old days. My plan is to go to Hot Springs of Virginia for the summer, so I can take the bath treatment again that seemed to do me some good at Watkin's Sanitarium last summer."

This case is still unfinished as my readers will see, and I have omitted much that is of interest. The typhoid vaccines were suggested by one of the consultants but he admitted its failure in chronic cases, while it was opposed by others equally experienced. I am indulging the hope that one or two more orthopaedic meas-

ures may be resorted to—namely, the injection of oil into the joints and arthroplasty. In one case similar to this one I am credited with having secured a fair range of motion in the knees and ability to walk without aid, by an arthrotomy supplemented by a removal of the ligamentum alarae. In the case I have just reported at length, massage was not tolerated but active movements during the intervals between exacerbations were decidedly helpful.

The next case presented is of interest to the writer because an electrotherapeutist noted for his claims of cure in paralysis chided me at one time when I asked him about his results in the treatment of the chronic arthritides, for not abandoning all orthopaedic methods and sending my patients to one skilled in the use of the violet ray, the static, the galvanic and the sinusoidal currents. When one boasts of his results in the treatment of palsied muscles and dangle legs from poliomyelitis, and of the wonders effected by static electricity, my credulity is taxed to the limit. A few months after the interview there came into my office a woman hobbling along on two canes and in getting her history she told me that she had been under the care of this very doctor for over six months, regularly two or three times a week—coming in from a Jersey town for the treatments. She described the long sparks as she sat on the insulated stool, so very familiar to me (I played with the static machine during my internship in hospital for thirteen years under the orders of my chief, a past master in the use of that current). She described the violet ray and the silent current. She lost faith and was discouraged. I found her so crippled and traveling so painful that I advised her admission to the Hospital for the Ruptured and Crippled.

Case II. (Hospital No. 15747). Mrs. C. L., age 37, admitted July 11, 1918. Nine years ago first symptoms presented without known cause—knees first affected, later wrists, fingers, elbows, shoulders and ankles. Five years later had a course of treatment in Mt. Sinai Hospital extending over a period of nine months. Exhaustive search was made for a focus of infection, and in that hospital no trails are left unexplored. In her home town internal medication was carried out thoroughly and finally she came six or eight months ago under the care of my friend the electrotherapeutist in his well equipped office in New York.

Our examination showed nearly every joint, including the temporomaxillary involved, except the hips. The knees were held in moderate flexion but motion was confined to only a small range, ankles painful and swollen. She could walk across the ward with assistance. I omit the details of the notes recording measurements, range of motion, pain, etc. Suffice it to say that at her own request a discharge was granted December 2, 1918, after a thorough course of several kinds of treatment, such as vaccines, made from cultures from the throat and teeth, implantation of colon bacilli after clearing up intestinal infection, the non-specific proteins of alfalfa and millet seed, nourishing diet supplemented by Emulsion of Codliver Oil and lime, superheated air for the joints, counter-irritation, immobilization for varying periods in plaster-of-Paris, braces after minor operations for the correction of deformity.

She walked with less pain than when admitted, had more use of her upper extremities, but on the whole, as shown by a full record of the condition of every joint, a cure or even a fair restoration of function could not be recorded. Late reports from the family physician are not encouraging.

CASE III. (No. 11095). A widow, age 43 years. Seen in consultation first on December 19, 1911. A diagnosis was made of *Arthritis of both knees, probably "rheumatoid."* History as follows:

Six years ago complained of pain about left elbow and right shoulder without known cause. From her husband who died two or three years ago the family physician believed she contracted lues or gonococcus infection. No proof, however, had been obtained.

A year or two after the first symptoms the knees became affected. Her physician, a most thorough practitioner, had for the past three years resorted to the usual search for a focus of infection. The treatment has included the thyroids, superheated air, massage and the stock vaccines of the streptococci and improvement followed temporarily every one of these agents. The case progressed slowly from bad to worse, and in July, 1911, took the course of treatment at Watkins Glen where she claims she grew worse deformed and more helpless, unable to walk on her return. The thymus was then employed, her diet was regulated and the pains in joints became less. She is now on crutches.

On examination I find her knees much enlarged, normal contour lost, painful on handling, patella movable over a good range, flexion of both knees 90°, extension of right to 165°, left to 180°—grating on movement suggesting erosion of cartilage. The right hip is involved, abduction and extension limited slightly, pain in this joint and in lower portion of spine. Nothing found in left hip, sacroiliac joints, elbows, wrists or ankles. No sign of decayed teeth though not X-rayed. Advised a Campbell brace for the right knee, counter irritation and strapping and a generous diet.

I did not see her again until January 30, 1918. The condition was pitiable. She gets about in a wheel chair or on crutches assisted by Thomas braces. Both shoulders are apparently ankylosed and painful on the slightest attempt at motion. Both elbows moderately involved, both wrists, left one the worse, one or two fingers, both hands, knees much worse than when I saw her in 1911. Crepitation of a bony nature in all of the joints affected.

The history given during this long interval is as follows: The brace was not employed but vaccines renewed without benefit. Was admitted to the Corey Hill Hospital in Boston in May, 1912, coming under the care of a well known authority on the arthritides. After a thorough search for a focus with negative results (her own report) the shoulders were moved under gas, and the deformity of the knees was treated by the Thomas calliper splint. In September the knees were moved under gas and immobilized for a short time in plaster-of-Paris; her tonsils were removed about this time and reported as very foul but no vaccines followed this operation. She was removed in November to the sea shore where massage and active motion were employed for two months. Returned to New York early in 1913 with instruction to continue exercises, but at this time she was quite helpless requiring the services of a well trained nurse night and day.

A proctologist of international repute gave three or four gonococcus serum injections early in 1917 and the last one was followed by increased swelling of the wrists and a general urticaria. In February, 1917, she suffered a severe shock from the death of her mother and all symptoms were aggravated and helplessness became extreme. Such was the condition when I called and I confess that my first impulse was to "take to the woods," but she was so pathetic in her appeals for relief that I made an attempt to

give support to her spine and sacroiliac regions by a specially constructed corset and abdominal belt combined, to her lower limbs by a light pair of Campbell braces which would be an improvement on the Thomas calipers, to correct any intestinal toxaemia by a study of the stools (this region I found was the only one that had not been explored) and the usual treatment if found highly toxic and the sinuses which she claimed were prevalent by calling in a laryngologist. "Findings show a highly offensive, highly acid, highly toxic stool with heavy reactions for blood coloring matter and the bacteria almost totally Gram positive." This was February 1, 1918. Appropriate treatment was instituted and on February 27th the report from the laboratory was: "Except for the acid reaction, there is nothing in the findings worthy of comment."

The Laryngologist reported March 9th:

"The culture from her throat and nasopharynx showed a growth of staphylococcus aureus and Gram negative diplococcus."

Naturally my prognosis which was eagerly sought was carefully guarded. Without prolonging this already long drawn out report merely want to say that after three months treatment with very infrequent visit I failed most signally to satisfy either the patient or the nurse and left the case in *statu quo ante*.

CASE IV. (No. 12662). Mrs. F., age 35 years. June 2, 1915. Diagnosis. Arthritis both knees probably infectious. Twelve years ago had "rheumatism," involving the knees principally, with a fair recovery. A recurrence during the past year under excellent treatment consisting of massage, superheated air and a diligent search for a focus such as a radiograph of the teeth finding an abscess at root of right central incisor, the necrotic area extending into the nasal fossa. The tooth was extracted, a culture showing streptococci, taken and a vaccine made and used for three months with negative result. At the time of extraction of the tooth the knee was aspirated and fluid contained the same streptococci that was found at the root of the tooth.

On examination on above date both knees showed change in contour, distinct fluctuation, patella freely movable, flexion nearly normal, extension to 180° on one side, 170° on the other.

June 8th. Through a one-inch incision a small amount of serum and pus evacuated, cavities swabed with sterile gauze, wound closed and strapped.

June 11th. Has been no reaction. Measured for a pair of Campbell braces with limited range of motion at knee.

June 21st. A few days after last note the joints had refilled and incision made with through and through drainage but tubes were removed soon afterward because of a rise in temperature.

July 15th. The discharge has ceased, wound about closed and strapping renewed while the left knee is provided with a good fitting brace. She goes to the country for the summer under the care of a local physician.

September 25th. Find her walking with aid of brace and crutches, no reopening of wounds while right knee appears about normal. There is a suspicious swelling with impaired motion in left wrist, right elbow and right ankle.

November 18th. Has returned from the country and in consultation with her physician I find that he has removed the tonsils and adenoids finding an abundance of streptoccoci. The day *following* there was no pain in any of the joints involved but the *next* day pain was a prominent symptom. In addition to the joints already involved, I find the right temporo-maxillary, the left elbow and left wrist, affected but not markedly. Begins the pituitary extract hypodermically. Massage to be employed more regularly.

February 18, 1916. The improvement since last note is at least 25 percent and while one of the consultants attributes this to the pituitary extract, the other regards the cod liver oil and iron which was begun about the same time as the more important factors.

This patient continued to improve and at the time of my last note was walking a quarter of a mile easily, could go up and down stairs with a little assistance, although the following joints were affected: Shoulders, range of motion two-thirds the normal, elbows about three-quarters; wrists very nearly normal; the proximal phalangeal joints, slightly; knees, a range of motion from 135° (the limit of flexion) to 175° for the left and for the right, 150° to 180°, ankles very nearly normal.

The case I am about to report is in a man who attributes his relief to the physical exercise and discipline of a sanitarium in Chicago.

CASE V. (No. 13806). Male, age 39 years. *December 29, 1917,* suffering from a lesion about the sacro-iliac region suggesting a diagnosis of sacro-iliac *Arthritis* or *Periarthritis,* right, *probably* infectious.

Three years ago without apparent cause, unless it be lifting and other severe exercise incident to his vocation, pain was felt in the lower spinal region and was aggravated by ordinary exertion. A careful examination failed to discover anything abnormal in spine, iliac fossae or hips. The only sign pointing to sacro-iliac lesion was a tension of ham strings as leg was extended and flexed thigh right side. He complained of pain extending down both sciatic nerves and fatigue and lameness on slight exercise. A tonsillectomy in August, six teeth extracted because of suspicious skiagrams and yet no relief.

I could explain the symptoms in no other way than as a traumatic lesion and proceeded to fit him with a brace that is used for the relief of sacro-iliac sprains, although he contended that his digestive organs were behaving in a very unsatisfactory manner notwithstanding active treatment at the hands of his family physician.

His spine and pelvis were ordered X-rayed and the report was negative.

April 10, 1918. A letter under date of the 9th said "My back is no better, the brace was not beneficial, yesterday had a very bad spell."

April 17th. Still complaining of pain and I applied a solid skin fitting plaster-of-Paris jacket. At the same time he began a course of intestinal irrigation to be followed by implantation of B. Coli inasmuch as the laboratory findings under date of January 2, 1918, showed "a highly acid, extremely toxic stool with large number of meat fibres and heavy blood coloring reactions" while the bacteria were "almost totally Gram positive."

June 13th. Two courses of intestinal treatments have failed to relieve and the last report from laboratory a day or two ago still show Gram positive bacteria and an *alkaline* extremely toxic stool.

From this time to *June 26, 1919,* I saw him very infrequently but had letters complaining of increased pains, of the inefficiency of braces and jackets of various kinds as well as the failure of a

course of the non-specific proteins, etc., etc. In other words he sought relief at a health resort in Chicago where seven weeks intensive treatment *almost* effected a cure. The course was as follows:

"Four days on oranges, twelve days on water alone with little lemon in it; then two days of oranges and four weeks on exclusive milk diet. Lost twenty pounds during this time but gained same before leaving. Had hot bakes, massage, etc., and lost all pain, was able to bend further forward without discomfort. During his last two weeks stay was in gymnasium for two hours a day. He then had osteopathic treatments every day because of a tender point in his right loin which the osteopath said was due to a floating rib."

Since his return has been back at work and been active. His general condition now is very good; no point of tenderness along spinal column, can bend forward almost normally but if he attempts to lift anything very heavy has pain in his back and has difficulty in straightening up but when he gets straight is alright; nothing felt in iliac fossa, in fact all he has remaining is pain across top of pelvis. All the pyorrhoea had before went to Chicago has disappeared as testified to by his dentist.

CASE VI. (No. 13535). A widow, age 65 years.

June 12, 1917. Suffering from an *Infectious Arthritis both knees* of "long standing" after two years treatment along lines similar to those in preceding cases. Attributes the relief obtained to the persistent use of the cautery and strapping supplemented by a Campbell brace for the right limb. Many psychic disturbances incident to the late war have complicated the cases and yet decidedly good results are noted.

My object in reporting these cases is to call attention to a class very unsatisfactory to handle "shifting from pillar to post" and responding for a while to every new form of treatment.

I may be pardoned for inserting a quotation from "Tonics and Stimulants" in the Journal of the A. M. A.

"Time for Consultation"

"The niece of Mrs. William Mills, who lives at her home, returned from Kansas City Thursday night, where she underwent an operation by which her tonsils were removed. That her case puzzled physicians is shown by the different diagnoses made by different doctors. Dr. Woods, of Princeton, first diagnosed her trouble as appendicitis. Dr. Norberg, of Kansas City and Dr. Dugan, of Ottawa, confirmed his conclusion and the latter operated on her on Easter day for that disease. But her suffering did not stop. Dr. Woods examined her again and pronounced her affliction rheumatism. Dr. Mills decided she had neuritis and Dr. Norberg, this time, expressed the belief that she had a kidney stone and sent her to Kansas City for an X-ray examination. Dr. Howard who put her under the X-ray found that the real source of the difficulty was pus on the tonsils and after he cut them out, the trouble was over. (Later—Since the above was put in type, the young woman has suffered a relapse, but Dr. Mills still believes the operation will be a success.)

Conclusion.

1. A focus of infection should be diligently sought for in every case of Arthritis where tuberculosis, malignancy or trauma are not self-evident as causes or at least controlling factors.

2. A nonarticular arthritis demands the same painstaking investigation as does a polyarticular, for one can never tell when the former may merge into the latter.

3. While the finding of a focus and the proper handling of the same may not be followed sooner or later by relief, one can not assume that the infection is at an end.

4. The arrest of the infection does not mean that the exudates in and around a joint will disappear unless orthopaedic measures are employed to bring about resolution and restoration of function.

5. The finding of one focus does not mean that this is the only focus bearing on the case. It must be remembered that many organs are exposed to bacteria of a pus producing nature and that a careful study of these organs should be the rule.

I hesitate in publishing such a record of cases, no one of which seems to be complete. I simply love to get end results but in my reading and discussions before medical associations I get the impression that the arthritides are the most difficult we have in orthopaedic surgery; and while they naturally come under our care it would be well to rely on a "medical group." No one man can, in my judgment, conduct all of these cases to a successful issue.

CHONDROMAS

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Among the bone tumors that tax the diagnostic ability of clinician and surgeon are the cartilaginous tumors which, though non-malignant, may suddenly assume aspects of such rapid growth as to lead to an alarming prognosis and to unwarranted surgical intervention. Even with careful history-taking and the accumulation of clinical, laboratory, and x-ray findings the diagnosis may remain obscure until surgical measures permit a pathologic study of the cellular activity in the tumor-mass.

The material discussed in this paper represents the proved cases, both pathologically and surgically, of chondromas that have been observed in the Mayo Clinic within the past seven years. Osteochondromas, chondrosarcomas, and so forth, will not be considered.

Enchondromas and ecchondromas are usually composed of hyaline cartilage supported on a fine framework of fibrinous connective material with remarkably little vascularity. Occasionally irregular bony-deposit trabeculations are found. The enchondromas arise from some area not normally associated with cartilage while the ecchondromas arise from sites of pre-existing cartilage and are possibly more of a hyperplastic tumor formation.

To rickets, trauma, displaced embryonal rests, syphilis, and a transition of connective tissue cells has been ascribed the cause of chondromas. The last cause appears the most reasonable because of the presence of cartilage and tumor-formation in various organs. The exciting cause, however, may not be apparent; it may depend on a variety or a combination of causes. In my own experience trauma has very often been a pre-existing factor in the production of such tumors. They occur frequently before the age of puberty and even in the new born. In the cases under discussion the tumor appeared comparatively late, but the history often led back many years before the growth was first noticed.

Chondromas may be single or multiple. They may arise in and about joints and cause loose bodies, and so forth. The symptomato-

logy varies: It is dependent somewhat on the location, size, and condition of the tumor-substance. Thus a tumor may feel hard in the early stage, and later present a palpable surface not unlike a cyst or a bursa, due to the mucoid degeneration which is almost sure to occur in the later stages, or a superimposed bursa may arise from repeated irrigations. As a rule chondromas are hard, lobulated, firmly attached, painless masses, not adherent to the skin. They may cause aching and tenderness if they are large and make pressure on sensitive structures. In long standing cases with the formation of tumors, shortening or fracture may occur. In the area of the tumor there is an absence of enlarged veins so often found in the region of malignant neoplasms of the osseous system. Local heat is absent unless there is degeneration and secondary infection; pulsation is absent. The x-ray pictures are not always characteristic.

Fibrocystic disease, giant-cell tumors, and more rarely, malignant bone tumors and osteomyelitis may produce shadows resembling chondroma so closely that the true nature of the tumor is not recognized until operation is done and a pathologic specimen is examined. The x-ray alone may not give sufficient evidence on which to make a diagnosis; however, it is of great value in that it determines readily the extent of involvement and the differentiation of the single and multiple types. The common use of the x-ray in fracture work in the future will undoubtedly reveal the presence of chondromas and other bone tumors with increasing frequency. Surgeons should not overestimate their ability to read the x-ray plates. Very often bone tumors are interpreted as malignant when careful history-taking and clinical examination might have led to a more guarded prognosis and to more conservative surgery. A study of the roentgenographs in these cases leads one to divide chondromas into two groups:

Group 1, in which the bone presents oval, transparent areas with edges clearly marked out from the surrounding bony structure. The area usually involves the medullary substance near the epiphysis and slowly thins or compresses the cortex by bulging it outward, forming round or lobulated masses without breaking through the periosteum or invading the soft tissues.

Group 2, in which many irregular, ramifying, homogeneous areas of various sizes and shapes are separated by lines of various thicknesses and directions, and by coarser lines due to the

shadows thrown by the bone trabeculations. The areas show the absence of periosteal involvement or a tendency to invade the soft tissues. They also show a tendency to invade the cortex rather than to bulge it out or to cause its absorption from pressure. Calcification or ossification may occur and will be noted by their characteristic appearance.

It was noted in many of our cases that chondroma tends to arise near or in the epiphyseal line and to invade the epiphysis as well as the diaphysis. This causes a picture resembling that of giant-cell tumors yet it is often apparent that the striations and trabeculations are coarser and that the shadows are deeper in chondromas. As I have noted,* in the cases reported as cystic and fibrocystic disease of the long bones, there is an absence of the epiphyseal involvement. This distinguishing feature of fibrocystic, giant-cell tumors, and the heavy and coarse trabeculations characteristic of chondromas would indicate that the two might be differentiated roentgenographically. It should be remembered, however, that the x-ray cannot disclose the exact nature of cell activity. A tumor may have the appearance of a benign growth yet some portions of the mass may be malignant. During the early stages this will not be manifested by the x-ray although later the condition may be accurately diagnosed from the plate alone.

Preoperative laboratory tests, in our experience, have been of little value other than negative in making a diagnosis. The Wassermann tests have been negative, and urinalyses have shown the presence of albumin in a few cases. In one case of multiple chondroma Bence-Jones protein was noted.

Treatment

Chondromas should be treated surgically, and the earlier the operation is done the better the prognosis. Incision and curettage is usually sufficient to produce a cure unless the tumor has become large or is likely to interfere with joint action. In such cases radical measures may be indicated. If the tumor bulges into the soft tissues, it may be wise, after curettage, to crush the wall and allow the cavity to be closed by newly formed bone. This also reduces the deformity.

At operation an encapsulated, firmly adherent, hard tumor with or without a superimposed bursa presents itself. On opening

the thin cortex the tumor may be shelled or curetted out with surprisingly little hemorrhage. The mass is a pale, bluish-gray, fragile tissue which on section is shown to be hyaline cartilage. No packing is required, and the cavity may be allowed to fill with blood clot or a fat transplant may be used. If the bone is thin to an extent that would make fracture imminent, a cast or splint should be applied.

The prognosis following operation is good. Occasionally the tumor may recur or more rarely may become malignant. Sections from various parts of the tumor should be examined, especially those parts exposed to repeated trauma, since it is here that malignant changes are most likely to be found. Varying

FIG. 1. (223429) Chondroma of the epiphysis of the right femur; cyst at inner condyle. Chondromas of the outer condyle, and one just above the intrachondylar notch. (Front view.)

amounts of cartilage may be present in the malignant tumors. The tissue, therefore, should be studied histologically, for the gross appearance may deceive the surgeon and a prompt recurrence both locally and generally would soon show the true nature of the growth.

Report of Cases

Case 1.—(34944) W. A., a boy, aged fifteen years, came to the clinic for examination March, 1910, complaining of a tumor of the left great toe. The toe was painful and tender. The patient's home physician had excised a portion of the tumor for "proud flesh" and had trimmed the nail which grew at right angles to its normal position. The formation of the tumor was ascribed to an injury to the toe eighteen months before. The examination at the clinic was negative except for the presence of

Fig. 2. Same as Fig 1. (Side view.)

a firm, apparently cartilaginous mass under the inner border of the left great toe. This was excised under a general anesthetic, and on pathologic examination was found to be a chondroma. One year later the patient returned with a recurrence. A second pathologic examination again showed the condition to be chondroma. Seven years later in answer to a letter of inquiry the patient states that he is an officer in the army, that he has had no further recurrence and is in excellent health. (Note: This chondroma apparently resulted from an injury, was of slow growth, and was successfully treated by conservative surgery.)

CASE 2.—(82057) T. F. S., a man, aged forty years, was operated on March, 1913, for ulcer of the duodenum. A posterior gastro-enterostomy was done. At this time also a tumor of the left thumb was excised and found to be a chondroma. The tumor had been growing slowly for three years. Six years later the patient stated that his health was excellent. He had gained sixty pounds in weight, but a swelling had appeared at the site of the excision of the chondroma within a year after the operation.

CASE 3.—(86693) E. L., a girl, aged seven years, was examined June, 1913. Two years before, the patient had had a severe attack of fever which had confined her to bed for three months. During this time it was noted that tumors were forming on her right hand. They grew slowly the first year, but during the second year they increased rapidly in size and caused pain and tenderness, particularly just before a storm. The clinical examination showed several tumors of the fifth metacarpal, one on each of the proximal phalanges of the fourth and fifth fingers of the right hand. There was no sign of inflammation and no tenderness. The Wassermann test was negative. The tumors were curetted and cauterized with the actual cautery, and iodoform gauze packs were inserted. Pathologic examination showed the growths to be chondromas. The patient was examined four months later, clinically and by the x-ray. She showed marked improvement except for a slight recurrence on the fifth finger which required similar treatment. Five years later the patient stated that her health was excellent and that she had had no definite recurrence of the condition.

CASE 4.—(89241) P. J., a girl, aged nine years, came for examination August, 1913, because of a tumor on the right great toe which had formed following an injury four months before.

A poultice had been applied to the inflamed toe with some relief, especially after the pus was drained. The toe, however, remained sore, and very soon afterward a tumor was noted which gradually increased in size and caused pain on walking or when touched. The mass had elevated the nail. An x-ray picture showed partial destruction of the distal phalanx. The tumor had been diagnosed sarcoma, but operation and pathologic examination revealed chondroma. Five years later the patient reported "no recurrence and condition very satisfactory."

Fig. 3. (226027) Multiple chondromas of the hands.

Case 5.—(85910) A. B. M., a woman, aged forty-five years, was examined August, 1913. She complained of a recurring tumor of the little finger of the right hand, a tumor of the outer lower quadrant of the right breast, which had been present for twenty-two years and occasionally caused stinging pain, and a tumor of the right arm. At operation the right breast was amputated and the tumor found to be adenofibroma. The tumor of the arm was a lipoma, and the two tumors of the fingers were chondromas.

Case 6.—(102631) P. C., a boy, aged nine years, came to the clinic March, 1914, because of a tumor of the proximal phalanx of the little finger of the left hand. The growth had been slowly

enlarging for one year, but it did not cause pain nor discomfort. The x-ray showed a partial destruction of the phalanx. The material was curetted out and was found, pathologically, to be a chondroma. Four and one-half years later the patient reported that he was well and had had no recurrence.

Case 7.—(79771 B. K., a man, aged twenty-five years, was sent to the clinic in July, 1917, by his home physician because of a tumor of the fifth metacarpal bone of the left hand. The tumor had been present twelve years without symptoms. It had recently been injured and malignancy was feared. The examination disclosed a firm, hard tumor of the distal portion of the fifth metacarpal bone of the left hand. The x-ray picture showed a cystic area traversed by coarse, irregular trabeculations. The tumor bulged outward, causing a thinning of the cortex without noticeable change in the periosteum or invasion of the soft tissues. At operation the curetted material, grossly and microscopically, resembled chondroma. The bulging section of the cortex was crushed in and the wound closed without drainage. Primary union occurred. No response was obtained from a letter of inquiry sent to this patient.

Case 8.—(93747) A. L., a man, aged twenty-two years, was referred for examination October, 1913, by his family physician because of a firm mass that had been noted in the region of the right lesser trochanter three months before, and which had been slowly enlarging and causing pain. Malignancy had been diagnosed. No definite history of trauma was given. Examination was negative except for the tumor, which caused an increase of four inches in the circumference of the thigh and hindered adduction. The patient was apparently in excellent health. There were no enlarged veins about the tumor and no tenderness. An x-ray diagnosis was made of sarcoma. The bony feel, however, and the lack of venous enlargement, the general good health of the patient, and the density of the tumor mass in the x-ray picture led to an exploration through an anterior incision. The tumor, which was removed, consisted of cartilage. Its base was cauterized and a small strip of gauze was used as a drain. The convalescence was uneventful. Two months later the patient came for observation. X-ray of the chest and thigh failed to reveal any recurrence.

Case 9.—(112418) G. M. Z., a man, aged thirty-eight years, was examined June, 1917. A tumor had been present for fifteen years on the middle phalanx of the second finger of the right hand.

The growth was hard and firmly attached. It caused stiffness of the finger but no pain. The size had remained stationary for two years. The patient had had repeated attacks of tonsillitis, and three weeks previous to examination septic tonsils had been removed. A diagnosis of chondroma was made from the x-ray, clinical findings, and the duration of the growth. No operation was done.

CASE 10.—(115921) J. A. S., a woman, aged forty-three years, came for examination September, 1914, because of a tumor in the lower end of the sternum. The growth had been noticed

FIG. 4. Same as Fig. 3. X-ray taken just before operation.

five months before and had slowly increased in size, causing pain in the costal arches, especially of the left side. The patient was very uncomfortable while lying down and for the past three weeks had sat up all the time. She had lost strength and ten pounds in weight and had a dry cough. Clinical examination revealed a firm, bony, slightly tender tumor one and one-half inches in diameter, of the ensiform. The x-ray of the chest was negative. The tumor was excised and on pathologic examination was found to be cartilaginous. The patient returned three months later, com-

plaining of pain in the sternum and chest through to the back. Her general health was good. The x-ray showed a dense mass in the right mediastinum. At operation a cartilaginous mass was found which involved the under surface of the sternum and extended upward into the pleura of the right lung so extensively that further dissection was deemed inadvisable. The material removed was pure cartilage. Eight months later the patient's husband reported that she was slowly failing.

CASE 11.—(122462) E. M., a man, aged twenty-four years, was examined January, 1915, because of tumors of the right hand which he had noticed one year previously. The growths did not cause marked pain or discomfort, but they were gradually enlarging. At the base of the first phalanx was a firm, painless, slightly movable tumor one-half inch in diameter. Between the second and third metacarpals were smaller tumors, and one extended over the palmar space of the second metacarpal. Operation revealed these tumors to be chondromas not connected with the bone.

CASE 12.—(126637) H. H., a man, aged twenty-two years, came for examination March, 1915. He complained of a slowly growing painless tumor on the right scapula which he had noticed six months before. A hard, bony mass two by three inches was palpable at the superior angle of the supraspinous fossa. The x-ray showed a calcified tumor of the scapula. On removal and pathologic examination it proved to be calcified chondroma. Two years later the patient wrote asking for a statement for an insurance company. He said he was well. Three years afterward he was discharged from the army because of tuberculosis of the lungs. The tumor had not recurred.

CASE 13.—(127640) H. R. H., a man, aged fifty years, was examined March, 1915. The patient had first noticed a tumor of the right knee twelve years before; it had gradually increased in size. There was no pain nor locking, but stiffness of the joint. A firm mass, apparently arising from the posterior surface of the tibia, was palpated in the right popliteal space. It was movable, and limited flexion to ninety degrees. The skin was scarred from previous treatments, heat, and so forth. The Wassermann was negative. The x-ray showed calcareous deposits in the popliteal space and marked bronchial thickening. The tumor was removed and the base cauterized. Gross and microscopic examination showed it to be a chondroma. Three years later the patient re-

ported that he was in good general health and that there was a small lump on the outer side of the knee, which had not enlarged in the past year.

CASE 14.—(140353) N. R., a girl, aged seventeen years, was examined September, 1915, for a tumor of the proximal phalanx of the little finger of the left hand. This finger had been caught in a door and the phalanx fractured when the patient was eighteen months old. Five years later a tumor formed, and after enlarging slowly for six years it remained stationary. The tumor

FIG. 5. Same as Fig. 4. X-ray taken six months after operation.

limited motion of the finger and caused pain with movement. Examination revealed a hard, fixed tumor one-half inch in diameter at the base of the proximal phalanx. The x-ray picture showed a tumor bulging into the cortex but not involving the periosteum nor perforating into the soft tissue. Its central portion was transparent and crossed by numerous coarse trabeculations. The tumor was curetted out and proved to be a chondroma. Two and one-half years later the patient wrote that there had been no recurrence.

Case 15.—(223429) J. L., a man, aged thirty-two years, came for examination February, 1918. For the past two years the patient had noticed at night a dull pain in the right knee and occasionally in the left. There had been no disability and he had continued to work up to the time of his examination. Examination revealed slight tenderness over the inner side of the right knee and slight limitation of flexion. The x-ray showed cystic areas in the epiphysis of the femur without involvement of the periosteum or perforation into the soft tissue; it was multilocular with coarse trabeculations. At operation a multiple lobulated, cartilaginous mass was removed. Beside the mass, just above the inner condyle there was a cystic cavity about one inch in diameter. The wound was closed after a thorough curettage. Pathologic examination showed chondroma. One year later the patient was in good health and without local recurrence (Figs. 1 and 2).

Case 16.—(226027) H. B., a man, aged eighteen years, was examined January, 1918. At the age of two years the patient had developed a tumor of the proximal phalanx of the fifth finger of the right hand. There was no history of trauma. Within the last four years new tumors had formed on the metacarpals and phalanges of both hands. These grew at approximately the rate of body growth; they caused little discomfort and no pain unless traumatized. There was surprisingly little disability considering the size and number of tumors. The patient was referred by his physician because of the deformity, and with the diagnosis of chondromas. Operation consisted of curettage of cartilaginous material, and cauterization of the cavities. Six months later the patient showed marked improvement. (Figs. 3, 4 and 5.)

Case 17.—(237157) W. H. W., a man, aged forty-one years, came for examination July, 1918, because of flat feet. When the patient was eighteen months old, his right hand had been crushed in a door, and following this tumors developed and grew until his nineteenth year. His physician had advised against surgery. He had worked steadily as a carpenter and had been inconvenienced only by limitation of flexion of the first finger. A diagnosis was made of multiple chondromas of the right hand. No operation was performed.

Case 18.—(168792) J. B. W., a woman, aged fifty-three years, was examined August, 1916. The patient complained of nervous indigestion, insomnia, rheumatism, and lameness of the

left knee. Lameness and stiffness had been present for seven years although there was no limitation of motion, no deformity, or tenderness. A diagnosis of sarcoma had been made elsewhere, and amputation had been advised. No definite enlargement of the knee nor limitation of motion was found. The urinalysis was negative; the hemoglobin was 80 per cent; the leukocytes, 5,200. The tonsils were enlarged and contained septic material. The x-ray showed

FIG. 6. (168792) Chondroma of the lower end of the femur. Note the involvement of both epiphysis and diaphysis and the extension to the knee joint but not into it. The periosteum is normal except at the point of exploration. Cortex and medullary bone are both involved with areas of lessened density while trabeculations are marked and coarse. (Front view.)

the presence of a tumor in the lower end of the left femur (Figs. 6 and 7). Other x-ray findings were negative. August 18, 1916, the tumor was explored and found to be a chondroma. Radium was used. April 5, 1917, the tumor was curetted and the cavity filled with fat from the abdominal wall. The patient has continued to

walk since her operation three and one-half years ago. No evidence of further growth can be found clinically or roentgenographically.

Summary

Chondromas usually occur at sites of pre-existing cartilage, the epiphyseal line, and so forth, and involve the epiphysis and diaphysis. There is a greater tendency to growth into the epiphysis, where, at times, it apparently remains until late in the history of

Fig. 7. Same as Fig 6. (Side view.)

the growth. The periosteum is not involved and appears normal by x-ray and at operation. The cortex may appear normal by x-ray and at operation unless it is thinned by pressure or bulges out, or unless it is involved with the medullary substance, when it appears as a homogeneous tumor.

Chondromas do not invade the soft periosseous tissues as is so frequently seen in malignant tumors. Trauma appears to be an etiologic factor, especially in the growths on the hands. Although

these tumors occur most frequently in the young, they may occur late in life, and should be taken into consideration when other factors indicate benign tumor formation. Superimposed bursae may become injured, and a rapid swelling or a rapid growth may follow which is suggestive of malignant change or degeneration.

The contents of the tumor usually consist of pure hyaline cartilage in which a fine supporting framework of connective tissue is found, or it may be crossed by a bony network and trabeculations. The latter produce definite coarse lines in the x-ray picture which ramify in an irregular manner across the more transparent areas.

The history of the case, the clinical examination and the x-ray findings may present such a complex picture that it will be necessary to resort to surgery and pathologic examination in order to arrive at a correct diagnosis. Even benign chondromas may recur, and such recurrences should be carefully watched for malignant change. None of the cases in this series showed subsequent malignancy. It should be remembered that degenerating processes may cause cysts, probably due to pressure-degeneration and poor vascular supply. The x-ray is of great value in determining the size, location, and difference between the single and multiple varieties of chondromas, but it should not be depended on in making a definite diagnosis. There was a fairly similar picture between the giant-cell tumor and the chondroma in some of our cases. Surgical intervention in cases of chondroma should be conservative. The prognosis is favorable.

FOCAL PUTREFACTIONS AND THEIR BEARING ON OSTEOARTHRITIS AND OTHER DISEASES.

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PITTSBURGH, PENNSYLVANIA.

Read before the American Orthopedic Association at Atlantic City, June, 1919.

Until we have recognized the etiological factors in the study of disease, we will only temporarily relieve symptoms. The orthopedic surgeon may not hope to arrest the onward advance of an osteoarthritis until he has found the source of the toxin. He must, when necessary, call into council the pathologist, the internist, the genito-urinary specialist, the gastroenterologist, the radiographer, the laryngologist and the dentist. Secondary foci may become so very active and the pathological changes so destructive that even when the original source has been located and removed, these consequences may not abate in their activity, but advance to greater destruction.

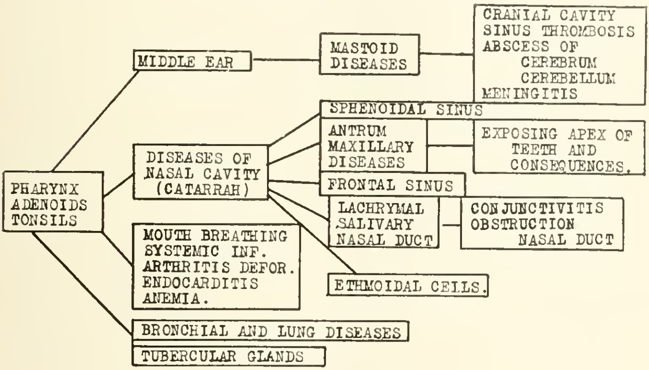
Our increased knowledge of internal medicine and the investigations that aim to furnish new light on systematic diseases with local and remote manifestations has led the clinician to assist as far as possible in working out a better understanding of these conditions. We are guided by the bacteriological experiments carried out in practically every laboratory in the United States.

We are indebted to Rosenow for the early work in this direction from the laboratory standpoint, as we are indebted to Frank Billings for his clinical studies. Heretofore it has been the custom to treat symptoms found in the various parts of the body with local methods. In more recent years we have learned that these local symptoms are often only remote manifestations of a blood stream infection, having its source in some putrefactive area. Specialties, without regard to other specialties, have recognized for some years the sources of infection in their particular areas of the body. These areas have not been assembled in such a way as to call attention to them clinically. As above stated, this was done as follows:

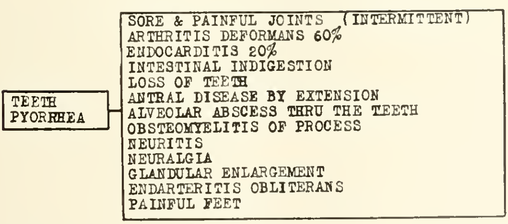
1. Diseases of the Throat.
2. Diseases of the Mouth.
3. Diseases of the Alimentary Canal.
4. Diseases of the Genito-Urinary Tract.

The following diagram is presented as the writer's view of the focal areas of putrefaction and the sequential chains of diseases. Certainly this is only the beginning—a mere suggestion—as compared with what may be expected from further study.

FIRST AREA OR THROAT GROUP



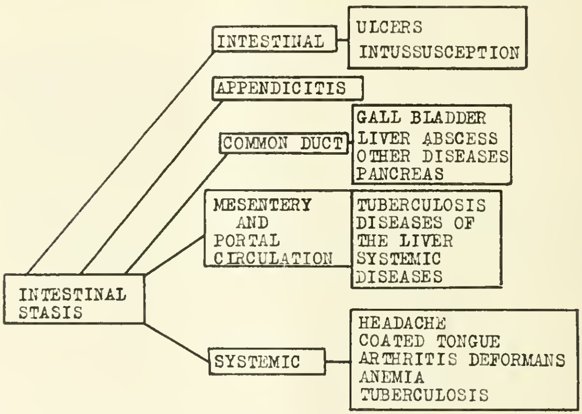
SECOND AREA OR MOUTH GROUP



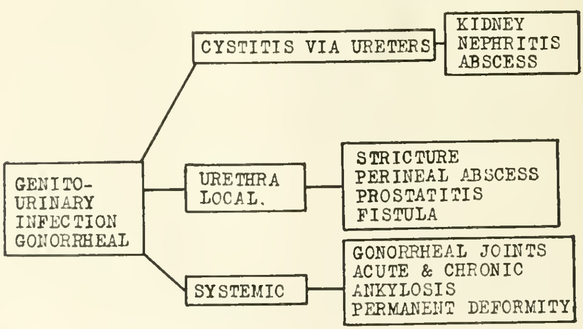
The first source of infection is the throat. A further detailed study will show that the conditions found in the throat include hypertrophied and ulcerating tonsils and adenoids. By a study

of the chart herewith presented you will find that all of the diseases of the middle ear and mastoid, and finally meningitis, intracranial abscess, sinusitis, etc., are traceable directly to the throat. Many of the diseases of the sinuses accessory to the nasal cavity result secondarily from adenoids or tonsils. It is a well-known fact that a great many of the tubercular diseases of the glands of

THIRD AREA OR INTESTINAL GROUP



FOURTH AREA OR GENITO-URINARY GROUP



the neck are secondary to tonsillar ulcerations. It is recognized principally in surgery at this time that the removal of tubercular glands of the neck is only done after the tonsils have been operated and that source of infection removed. As a rule, when this is done, the tubercular glands, which have lost their source of continued infection, will disappear without surgical interference. Formerly, many of these glands were removed by the writer, but in the last several years that operation has not often been found necessary. When the infection extends from the throat to the nasal cavity, it secondarily involves the three accessory sinuses, namely, the frontal sinus, the ethmoidal cells and the maxillary sinus; and while it is true that these sinuses may become infected in other ways, it must be admitted that a certain number of cases are found in individuals with ulcerating tonsils. The infection may extend from the nasal cavity through the nasal duct into the conjunctival cavity and result in infection there. It is most frequently the case that the nasal duct becomes obstructed, producing the usual symptoms of conjunctivitis, etc., and the escape of lachrymal fluid over the cheek. In antral infections it is not uncommon for the suppurative condition to destroy the mucous membrane of the floor of the nose, exposing the roots of the teeth, with the usual consequences. Mouth breathing, a consequence of throat or nasal obstruction, is caused by enlarged tonsils and adenoids, resulting in anemia, chlorosis, endocarditis, endarteritis, tuberculosis and general systemic toxemias.

The mouth is the second and most frequent source of systemic infection. Recently a man was seen who was so severely crippled in the hips and knees that he got about with great difficulty, and only by the use of a cane. It is unnecessary to state that he had been medicated and had visited watering places and taken baths and massage and other forms of manipulatory treatment, but he gradually became more helpless. When asked as to the condition of his mouth, he stated that it was all right, meaning that he had no pain, at least, not enough pain to require attention or special treatment. An examination of the mouth, however, revealed a lot of "old roots", which were partly worn off, and in some instances were broken off to the gum margin, with pus oozing from several points. It was readily concluded that the source of infection which caused the stiffness of his hips and knees was the absorption of the poison from the pus pockets around his teeth. He was suffering from a severe form of pyorrhea.

A woman, aged 70, presented herself for examination, barely able to walk, owing to stiffness and enlargement of both knees. An examination of her mouth showed four lower central teeth practically worn off to the gum line by an upper artificial denture which she had worn for several years. The removal of the teeth, which placed the mouth in a practically healthy condition, followed by the use of hypodermic injections of emetine, according to the methods recommended by the American and French authorities, completely cured this rapidly advancing case of arthritis deformans in three weeks.

It is naturally interesting to note further the method of infection. It is well to bear in mind the difference between a true infection, or infection caused by the introduction into a living tissue of a germ which destroys the cells, as in pneumonia and erysipelas, and putrefaction, where this variety of germ comes in contact with dead tissue, as when a blood clot is left in a tissue after a surgical operation, or when food particles are left in ulcerating pockets around the roots of the teeth and permitted to putrefy or decay. The poison from the infection produces temperature and destroys vitality in that way. It runs a very acute course, and will destroy life unless there is sufficient resistance within the body to combat the poison and throw it off, thus permitting the disease to run its course without a fatal end. In such infections, commonly known as blood poison, it is possible for the physician to destroy the germs and thus cut short the course of the disease. The symptoms are active and attract attention and require treatment, because they incapacitate the patient.

Such is not the case, however, in putrefactive changes within the body, notably in the case of pyorrhea. Here people have putrefactive changes going on within the mouth or stomach for years, and toxins are being absorbed from the pus pockets and taken through the system and deposited in some joint, or even in the valves of the heart, producing serious and sometimes fatal lesions. This absorption goes along so insidiously that very little attention is paid to it. The first symptom in the mouth is a slight tenderness about the teeth, or a little pus and blood will be discovered in the mouth in the morning when the tooth brush is used. This will be followed by bleeding from the gums. These conditions are not painful, and do not incapacitate the patient from pursuing his usual occupation.

The consequence of this continued absorption of the products or poisons from the pyorrheic changes about the teeth will be soreness in some joint, at first very slight, lasting for a few days and then disappearing, to develop in some other joint. These intermittent attacks may appear and disappear over a period of months and years, gradually increasing in intensity until eventually the joints begin to swell and the bone enlarges around the margin of the joint, and there results a corresponding stiffness or inability to use these joints. Finally the patient is no longer able to attend to his usual occupation, and from a cane he goes to crutches and finally to the invalid's chair, where he may live for years a helpless and dependent cripple. Homes for incurables have many of these cases, who, had they received proper treatment at the onset of the disease, could have remained useful members of society.

Emetine, which is one of the active principles of ipecac, is a recently discovered remedy; and while wonderful things are being accomplished from its use by the medical and dental professions, it is still in the experimental stage, and it will require several years before its true value is known. We only know at this time that it is the best form of treatment which has been offered for this most dreadful condition when the amoeba can be differentiated in the mouth of the patient. The mouth must be put into perfect condition by the dentist.

Endocarditis is due to systemic infection, the source of which may be in one of the four primary fields above enumerated. The writer has seen a case following an old alveolar abscess which had been packed by a dentist for several months. An emetine mouth wash must be freely used. Neglect of the mouth will cause a return of the joint and other symptoms.

The third source of infection, which has been studied in various ways and under various heads, is the alimentary canal. Constipation is an inactivity of the bowel. This results in the accumulation of feces and putrefactive changes. Constipation has more recently been studied under the head of intestinal stasis, especially since the introduction of the bismuth meal. It has also been considered by the proctologist under the head of obstipation. A member of this specialty is given credit for first calling attention to stasis of the alimentary canal and its consequences. Regardless of predisposing causes, or whether it is stasis, constipation or obstipation, the result is practically the same; i. e., intestinal

putrefaction and the absorption of the products of the saprophytic bacteria in the form of ptomaines into the general circulation by way of the portal or lymphatic circulation.

The secondary changes are made manifest about as follows: Local infections pass along the common duct from the duodenum into the biliary canal, resulting in infection of the gall bladder. It is thought that biliary calculi only follow putrefactive changes in the duct and the gall bladder. When the alimentary canal is in perfect normal condition, gall stones are unknown. The infection also extends along the hepatic duct into the liver, resulting in many of the serious organic diseases of this organ: abscess, sarcoma, cirrhosis and sclerosis. Infections of the pancreas occur in the same manner, resulting in acute and chronic changes in this gland.

All forms of tuberculosis of the mesentery, peritoneum and viscera are undoubtedly secondary to intestinal stasis and putrefaction. Appendicitis can only develop if infection occurs through the lumen of this structure by extension from the cecum. A normal and healthy alimentary canal precludes the possibility of the accumulation of putrefactive products in the various parts of the alimentary canal. It is a notable fact that appendicitis develops more frequently in individuals with constipation. Colitis and post-peritoneal abscess are the result of the absorption of infective germs from the alimentary canal. Systemic absorption of the toxins from the alimentary canal results in remote infections, notably endocarditis and arthritis deformans. Chlorosis and anemia are almost always found in individuals suffering from intestinal stasis, and it is reasonable to conclude that if the alimentary canal is in a normal condition and this source of infection is removed, such grave systemic conditions would be very rare.

The fourth source of infection is the genito-urinary tract. Here we have a vast area of intricate and complicated structures difficult to treat, in which occur a great number of serious and fatal secondary infections. The primary cause is gonorrhea, followed by urethritis, which, in a certain number of instances, is controlled during the acute stage, and no secondary diseases develop. Secondary diseases which are likely to follow are stricture of the urethra, resulting in perineal fistula, and finally in complete occlusion, retention of urine and uremia, and unless a skillful operation is performed, the case may terminate fatally.

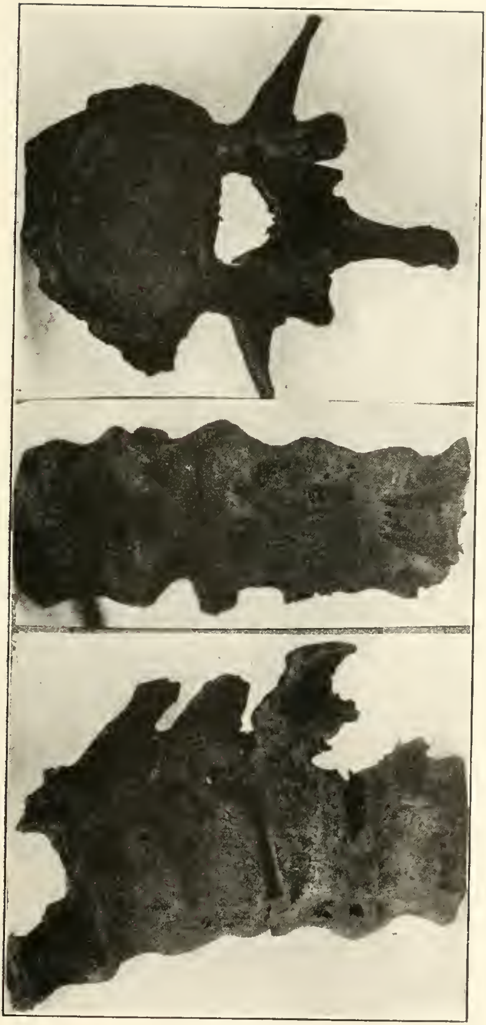


Fig. 1

Chronic urethritis, or gleet, when the infection extends to the prostate, results in chronic prostatitis, which has grave complications, as deep perineal abscess with extensive destruction of this area, which terminates fatally in many instances. Cystitis of a true chronic nature would practically be unknown, except in the senile form, if no acute urethritis had existed. Cystic infection extends along the ureters into the kidneys, causing all forms of nephritis, resulting in pyonephrosis and perinephrosis, which in many instances destroys the entire excretory function of the kidney. It is reasonable to believe that the majority of cases of tuberculosis of the kidney are secondary to acute specific urethritis.

Systemic infections from chronic genito-urinary diseases are acute and chronic gonorrheal arthritis, resulting, in the majority of instances, in ankylosis and permanent deformity of the extremities. Statistics show that in about half of the cases of arthritis in adults the disease is secondary to gonorrhea. Gonorrheal infection in the female accounts for ninety percent of all pelvic abscesses. This conclusion is based upon the statistics of a number of gynecologists. In women who have had a gonorrheal infection of the uterus and tubes there is also sterility. Another complication of this infection in the female is irregular menstruation. In infection of the ovary, resulting in abscess, if the cause is neglected, peritonitis and death result. Infection of the urethra and bladder may result in cystitis; and all of the diseases of the kidney, already enumerated as occurring in the male, may also develop in the female.

Figure 1 is made up of three photographs of vertebrae taken from different skeletons. Out of twenty-six subjects that were used in the dissecting room in one year, eight skeletons showed arthritis, and the conditions observed in these photographs are similar in character to those found in all of the skeletons. It will be noted that several vetebrae are fused together, the exostoses being so extensive as to completely fix the spine from one end to the other. The bone growth appears to be around the margins of the articular cartilages, lipping out horizontally to the long axis of the bone.

Figure 2 represents two vertebral columns and a portion of the skeleton. In this particular skeleton these osteophytic deposits were found around practically every joint in the body.

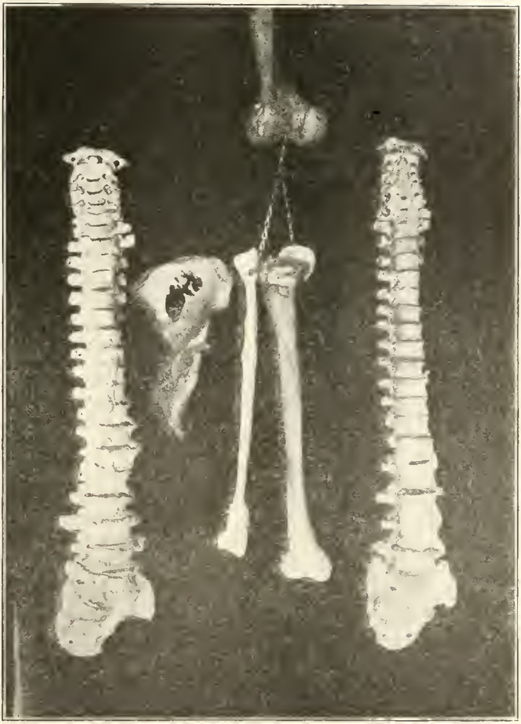


Fig. 2

It must be remembered that the dissecting material obtained for our use is gathered from the county hospitals, insane asylums, penitentiaries and morgues. All of these people were down-and-outers and drinkers, and had no regard for their personal health or the condition of their mouths or alimentary canals. In the majority of instances they had gonorrheal or syphilitic infections. True, all of these statements are conjectural, so far as definite information is concerned, but they are based upon a sufficient amount of information to make them reasonably accurate.

Discussion

Dr. J. K. Young of Philadelphia said his experience was the same as Dr. Gibney's. He took one or two weeks for examination of these patients, placing them in hospital and procuring the collaboration of the gynecologists, internists and laboratory men. If one could arrive at a diagnosis, one could treat the patient, if one could not, one could not hope to cure him. Early stages one could treat, in later stages, orthopedic measures must be resorted to. Thymus gland treatment was of help in some cases. One bedridden patient was enabled to go back to work by this means. Five grain doses were given, increasing until 35 grains a day were taken, then gradually decreasing.

Dr. J. Torrence Rugh of Philadelphia said that the gall-bladder was frequently a source of infection. He was treating 5 cases with a stock mixed vaccine, composed of staphylococcus, streptococcus, pneumococcus, and B. coli. In four cases the symptoms entirely disappeared. The fifth man was able now to put on his coat, and was going to get well.

Dr. John L. Porter of Chicago asked Dr. Rugh how he gave his vaccines.

Dr. Rugh said that in cases with history of gall-stones or tenderness in region of the gall-bladder, he gave 250 millions or ⅓ c c. If there was no reaction, he doubled the dose at the end of 4 days. If there was a reaction, he gave a smaller dose at the end of 5 days. No doubt better results would be obtained by gall bladder surgery followed up by the vaccine.

Dr. Walter Truslow of Brooklyn asked if he got good results with much distortion of the joints.

Dr. J. Torrence Rugh said that he got results with distortion of the joints. The enlargement all disappeared, but not the distortion. It was too late for that, but there was return of function.

Dr. Arthur Steindler of Iowa City said that he would mention the arthritides of children. He did not know the treatment, this was given by pediatricians. The etiology was often infection of the maxilla, and frontal and ethmoid sinuses. It was not enough to take out the tonsils, these were infected secondarily to the sinuses. Drainage of the sinuses would remove the trouble. Laboratory cultures made from the washings showed streptococcus hemolyticus. Injected into rabbits, one animal died, the others developed joint trouble.

Dr. Albert Freiberg of Cincinnati, Ohio, said that experience had been varied in regard to arthritides, presumed to be due to focal infections. If this were not so, they would not be discussing infections. They would have found out that removal of the focus cleared up the trouble. It was true that removal of foci was sometimes followed by remarkable effects, but there were cases in which removal of an obvious source of infection did not clear up the trouble in the joints. Men had been somewhat unreasonable in what they expected. There were two ways in which a peripheral joint might be diseased as the result of infection: (1) certain chemical toxic substances affected the joint; (2) actual living germs had lodgement in the joints and produced their deleterious action. If the joint disease be merely toxic arthritis, removal of the toxic material would repair the peripheral damage. With actual living bacteria, each joint became a new focus of infection in which damage went on in loco. One could not remove the joint, that was impossible, one could only help the constitution to eliminate the infection. Men talked as if there were a pipe line from the tonsils to the joints, but did not remember that if there were progressive disease, it went on after the removal of the primary focus. Unless one could dispose of the infection in the joints, one could not do anything.

Dr. H. P. H. Galloway of Winnipeg said that he could say a word in favor of thymus gland extract. In Still's disease it was a specific, and was of use in chronic arthritis of adults.

Dr. Virgil P. Gibney of New York said he believed in all that had been said except Dr. Freiberg's remarks. Logically one would suppose that the bugs in the joints would be the same, but it was not certain. Often when one examined a case of hip disease in children, one found no evidence of tuberculosis involvement. One got a history of the child having been ill about a week. On examining the throat, one found it full of enlarged tonsils and adenoids. One got wonderful cures in hip disease by taking out the adenoids.

Dr. S. L. McCurdy of Pittsburgh said that one might say there was no pipe line from the tonsils, but this was really a blood stream infection. The tonsils provided the focus of inflammation and if one did not get rid of them, it was impossible to cure the disease. The germs were there secondarily. They were not manufactured in an area of bacterial growth as in putrefactive foci. In gall-bladder cases, intestinal stasis led to gall-bladder involvement, mesenteric disease and a typical mesenteric infections. All of the visceral disease resulted from stasis. It was a bald statement, but one got to the point where one looked for a source of infection as the cause. In regard to vaccine or serum treatment, it made no difference what serum one used, it was the foreign protein that corrected the condition, rather than any particular variety of germs.

Correspondence

January 24th, 1920.

Dr. H. Winnett Orr,
Editor "Journal of Orthopedic Surgery",
Lincoln, Nebr.

Dear Doctor Orr:

In the January issue of the "Journal of Orthopedic Surgery" there is published an article by Capt. J. Paul Jones, of Camden, Alabama, entitled "The Treatment of Fractures of the Femur from an Orthopedic Point of View." The article takes up the treatment of fractured femurs by the application of a special type of bone traction, and describes in detail the apparatus, its application, its advantages, the general treatment of the cases, and the results obtained. The article is well written and well illustrated.

It is not the purpose of this communication to criticize this article, but the writer particularly desires to call the Editor's attention to the fact that the "Journal" has published an article in which the author has neglected (deliberately or otherwise) to give due and sufficient credit to Lt. Col. Pearson, R. A. M. C., who is responsible for the existence and perfection of the methods and technique described in such detail. This negligence is especially regrettable in view of the fact that all the illustrations are identical and with the exception of a few introductory remarks, the test of the article is ver batim that contained in an article on "Fractured Femurs," by Maurice G. Pearson, M. B., B. Sc., F. R. C. S., Major S. A. M. C., and J. Drummond, M. D., M. R. C. P. (Edin.), Capt. S. A. M. C. This article was mimeographed for limited distribution, but was not published, to my knowledge.

While in the Service it was my privilege, with certain other American officers, to be associated with the British at the Edmonton Military Hospital, London, England, for a period of many months. This hospital was one of the Special Femur Hospitals in Great Britain, and it was there that Lt. Col. Pearson organized and carried on with his assistants the work mentioned in the article under discussion.

The privilege of this great experience, associated with the extreme courtesy, kindness and hospitality of the British which was extended to Americans in other hospitals, as in this one, is something that we have ever to be grateful for. It is purely this sense of gratitude and the deep obligation felt toward the British that has prompted the forwarding of this communication.

For the official publication of the American and British Orthopedic Association unsuspectingly to have accepted and published in this country an article in which the true author has been deprived of all credit, surely necessitates an urgent obligation on the part of the "Journal" to see that due credit is given officially to the man who deserves that credit, and to no other. Such an

incident as this is indeed a sad commentary on the gratitude of those Americans who for so long were received as guests of the British Government during part or all of their Overseas Service.

Very sincerely yours,

(Signed) LIONEL D. PRINCE.

February 2nd, 1920.

Dr. H. Winnett Orr,
1010 Terminal Bldg.,
Lincoln, Nebr.

Dear Dr.

I have just received the reprints. I notice that you omitted the note appended to the foot of the proof sheet.

"I wish to thank Major Pearson, S. A. M. C., and Capt. D. W. Crile, R. A. M. C., for their active assistance in the preparation of this paper. Major Pearson is the originator of this method."

When you sent me the paper in September, to correct, I added this in a letter to you. Again on receiving the proof sheet, I wrote you to please add the above to the paper.

I do not want to claim to be anything but a reporter of this method.

Hoping that you will print this in your Journal, I am,

Very sincerely,

(Signed) J. P. JONES, M. D.

Personal Mention

Dr. Philip D. Wilson of Columbus, Ohio, has removed to Boston for association with Drs. Goldthwait and Osgood.

Base Hospital No. 9 has formed a separate Post of the American Legion in New York. Many of those who were associated at Chateauroux are active members.

Miss Leah Thomas, Head aide and Miss Margaret Blake, physiotherapeutic aide at Savenay during 1918-1919 are now associated respectively with Dr. Goldthwait in Boston, and Dr. Fitch in Rochester, N. Y.

Dr. Mitchell Langworthy has opened offices in the Paulsen Building, Spokane, Washington. He is associated with Dr. C. F. Eikenbary with practice limited to Orthopaedic Surgery including the treatment of fractures.

Dr. Frederick Cleveland Test has resumed practice at 30 North Michigan Avenue, Chicago. Dr. Test was in charge of the division of Orthopedic Surgery at Fort Dodge, Iowa, for more than a year.

Dr. Robert T. Pirtle has reopened his office at 310 Masonic Building, Louisville, Ky., with practice limited to Orthopedic Surgery.

Dr. F. Walter Carruthers has returned from military service and has opened an office in the Boyle Building, Little Rock, Arkansas, with practice limited to Orthopedic Surgery and diseases of children.

Dr. Harold D. Corbusier has returned from military service and resumed practice at 612 Park Avenue, Plainfield, New Jersey. Miss Dorothea M. Beck, late head aide in physio-therapy, U. S. Army, is Dr. Corbusier's assistant in physio-therapy and corrective gymnastics.

An Orthopedic School is to be established in Los Angeles, by the Orthopedic Foundation of Los Angeles. This hospital school is designed to meet the physical, educational and vocational needs of Los Angeles' child cripples. Mr. John Bruckman has donated

the site for this proposed institution. Thus far $60,000 has also been given for the purpose.

Mayor James Couzens of Detroit presented the Michigan Hospital and School for Crippled Children with $1,100,000 and the Children's Free Hospital of Detroit with $125,000, as Christmas gifts.

Dr. Edward C. Bull, who was in the Orthopedic service in Great Britain, is now at the University of California Hospital.

Last month a slip was inserted in the Journal, by means of which subscribers might remit for 1920 subscriptions. Many of these were returned resulting in quite a saving of postage for the Journal. Slips are again being sent with this issue for the convenience of subscribers who have not yet remitted. Répondez vous s'il vous plait.

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Bone, Buried, Experimental Study of,—Ely, L. W.; Annals of Surgery, Philadelphia, December, 1919, Vol. 70, No. 6, p. 747. Abst.: Journal A. M. A., Vol. 74, No. 1, p. 57.

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Bone Growth, Studies in,—Albee and Morrison; Annals of Surgery, January, 1920, Vol. 71, No. 1. p. 32.

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Current Orthopaedic Literature

THE CURE OF CRIPPLED CHILDREN. Sir Robert Jones, Liverpool, and G. R. Gridlestone, Oxford. *British Medical Journal*, 1919.

PROPOSED NATIONAL SCHEME

The authors state that the purpose of writing on this subject is to draw attention to the need and to bring forward proposals for the establishment of a system of orthopedic hospitals and clinics for the active treatment of cripples, the need of which is emphasized by the fact that there exist throughout the country children and adults in ever-increasing number who suffer from crippling diseases; and by the further fact that most of these are in work-houses or homes for crippled children or are seen on the streets as objects of sympathy. Especially is this need emphasized when it is realized that three-fourths of these cripples could be or could have been cured and the others greatly improved had their condition been recognized early and efficient treatment instituted. Due to the pioneer efforts of Miss Hunt, who started the Children's Orthopedic Hospital in Baschurch, a system of hospital and out-patient treatment has developed in Shropshire and Staffordshire. The proposals put forward concern the multiplication of such organizations throughout England and Wales and their general co-ordination under the Ministry of Health. The statistics from the institutions at Shropshire and Stoke, embodied in a table, show the approximate proportion of cases under treatment to the population of the areas served to be 1 to 594. Of these cases 40 per cent were under treatment for rickets and surgical tuberculosis, and congenital deformities and paralysis constitute 45 per cent of the total.

Relative to the general considerations as to treatment, the country has made no real effort to face the problem. Here and there an orthopedic hospital or an orthopedic department of a general hospital exists, but they are capable of caring for but a small percentage of the cases. The task is beyond the scope of general hospitals, as it is impossible for them to furnish ample bed accommodation in open-air country hospitals, or to anticipate the pre-operative, post-operative and progressive orthopedic measures required.

The proposed scheme embodies

(a) The division of England and Wales into a number of districts, not too large to prevent interworking of hospital and clinic. Where possible, a radius of fifty miles should not be exceeded.

(b) For each district an open-air country (central) orthopedic hospital, having adequate bed accommodation in open-air wards. It should be situated on dry soil with good aspect, near enough to town to have advantages of water, light, transport and drainage systems. In addition to wards are needed fully equipped operating theatres, gymnasium, handicraft work-shops, school rooms, playgrounds and administrative blocks.

For management, these hospitals should be affiliated with a general hospital or hospitals in the neighboring towns. The committee of management should

include representatives from the general hospital or hospitals, the orthopedic surgeons and matrons of the Central Orthopedic Hospital (C. O. H.), the district health officers, educational authorities and local authorities, thus insuring full co-operation for the development of every feature of the work.

The staff should consist of visiting or full-time orthopedic surgeons, radiologist, physio-therapist, house surgeons, matron, sisters, nurses, masseuses and school teachers. In the appointment of each of these great care should be exercised.

Out-patient clinics should be established for the supervision of after-care, and for preliminary examination of cases referred to them; also to treat such cases as may be out-patients throughout the course of their treatment. These clinics should be visited by an orthopedic surgeon and sister from the C. O. H. for consultation and supervision of work.

A general co-ordination of this work should be brought about by a committee working under the Ministry of Health, consisting of members of the British Orthopedic Association. This committee should make staff appointments, mold the general policy, and be responsible for a high level of efficiency.

It is estimated that the number of beds required would be 1 to every 4,000 population, or in round numbers 10,000 beds in England and Wales.

As to the finance, probably a complete hutted unit would cost 10,000 pounds, or the total expenditure 500,000 pounds. It is estimated that the total expense per bed per week is 2 pounds, or, for 10,000 beds, 1,040,000 pounds per year. The total expense for the out-clinic, supposedly serving 40,000 patients a year, would be 84,000 pounds.

From a national point of view, the improvement in the earning capacity of 40,000 or more treated annually should go far towards justifying the expenditure. Finally a plea is made, first, owing to the crying need; second, because the local authorities are now becoming alive to this condition of affairs and are anxious to have something done. Third, the unique opportunity is presented now since the Ministry of Pensions has organized orthopedic hospitals and clinics which, though full at first with crippled soldiers, will before many months have served their purpose and would aid in establishing the proposed scheme, and by its organization many thousands of children otherwise doomed to the life of cripples will be restored to health; and others, though not fully cured, enabled to become self-supporting citizens and given far greater possibilities of activity and happiness.—*J. E. M. Thomson.*

Cure of Crippled Children. W. I. de C. Wheeler, Dublin. *British Medical Journal*, Oct. 1919.

In referring to the paper by Sir Robert Jones and Mr. Girdlestone on "The Cure of Crippled Children," Mr. Wheeler states that it is a subject of national importance and deserves utmost publicity.

He draws attention to the extent of osseous tuberculosis in children of Ireland, Scotland and England, and to the inadequate facilities for proper treatment of such cases in certain districts. In Ireland there is not a single country institution available to care for the many cases in that country alone. *J. E. M. Thomson*

Experimental Resection of the Dog's Knee Joint. (Second Study.) By Leonard W. Ely, M. D., San Francisco, Calif.

After a fracture or a resection the whole tendency of the resulting process between the bones, unless they are held firmly together without motion, is the separation of the bone ends by fibrous tissue and fibrocartilage, with a new joint, before the bones can unite. In order for bony union to occur the bone ends must be held in contact absolutely immobile. In the ordinary fracture, Nature provides the immobility by a bony callus outside the cortex, in the periosteum. In those situations where the bony callus is not laid down, a false joint usually results unless complete immobilization is maintained until actual union of the bone ends occur.

In resection the external bone callus does not form. Unless the mechanical requirements of complete rest can be answered, resections of joints are not followed by bony ankylosis.—*Leo C. Donnelly, Detroit.*

The End Results of Joint Resection After Twenty Years of Observation. E. Kirmission. *Revue D'Orthopedie.* Sept., 1919.

201 cases are reported:

Resection of the knee, 118 cases; of the hip, 42 cases; of the elbow, 19 cases; of the tarsus, 20 cases; of the wrist, 2 cases.

Resection of the Knee. 118 cases.

Twenty-six cases were operated before the age of 5 years. Twenty-two cases were operated between the age of 5 and 10 years. Eight cases were operated between the ages of 10 and 15 years. Sixty-two cases were operated after the age of 15 years.

The cases operated on before the age of 5 years show uniformly bad results. Two cases were compelled to wear a brace. Eighteen out of 26 cases show deformity either of flexion in the knee or genu varum. One case developed genu recurvatum and in six cases there existed an excessive amount of shortening. In general the cases of this group are characterized by enormity of shortening and by almost invariable formation of deformed attitudes. This deformation occurs not only in cases where an amount of mobility was left but also in spite of complete consolidation; in flexion deformity of the knee the cause can be plainly seen in the curving of the lower end of the femur.

Cases operated between 5 and 10 years number 22. The result in these cases were practically the same as seen in the cases operated before 5 years and again the faulty attitudes prevail. Sixteen cases out of 22 showed faulty attitudes. In 4 cases the shortening is in the foreground. In only one case could the result be classified as satisfactory. Of the deformities subsequent to the resection here again flexion deformity was most frequent, followed by bow-leg deformity. In one case the deviation of the leg was almost at right angles to the femur. Only occasionally genu valgum is observed. In this group also there is only one case, a young woman of 20 years having been operated on 10 years previous, in which the result could be called satisfactory, the alignment being correct bony consolidation complete and the shortening measuring 9 cm.

Patients operated on between 10 and 15 years. Eight cases.

Here also faulty attitudes prevail. In 3 cases a most pronounced flexion deformity was observed. In 4 cases genu varum was found. Only in one case, among the 8 cases operated in this group, could the result be considered satisfactory.

This goes to show that in the long run up to this age resection of the knee gives bad results from the Orthopedic point of view. The dominating feature is the shortening which amounted to 20 cm. and more.

Cases operated after the age of 15 years: In contrast to the former groups the prospect of the patients operated at this age is much better. Sixty-two cases were observed among which 52 cases could be followed up. Twenty-nine cases or 50 per cent showed satisfactory result, the knee being solid in good position and capable of rendering excellent functional services. Only 5 cases among the 62 show faulty attitudes, 4 cases of genu varum and 1 case of marked flexion deformity.

Twenty cases showed a prolonged suppuration and distinct mobility which rendered the functional result less favorable and necessitated wearing of an apparatus.

Less favorable results are obtained from resection at a more advanced age, as the consolidation is often incomplete and normal mobility might result.

Resection of the Hip. Forty-two cases observed. Nine cases were operated before the age of 5 years. Twenty three cases were operated between ages of 5 and 15 years and 10 cases were operated after 15 years. Of these cases one was a young girl of 13 years operated at the age of 3 years. She showed decidedly bad result with persisting sinus and 8cm. of shortening.

A boy of 9 years operated 4 years previously showed a pathological dislocation of the femur with adduction and 5 cm. of shortening. A third patient operated at the age of 5 years showed 3½ years later an unstable joint and 8cm. of shortening. In this case the result was fairly satisfactory as there was good scarification of the hip joint.

In the fourth case, a boy of 8 years who was operated at the age of 18 months, the result was decidedly bad with a shortening of 23 cm.

In 5 other cases the position of the limb is satisfactory although the shortening is always considerable.

Cases operated between the ages of 5 and 15 years. In two instances, where the patients were operated at the ages of 8 and 10 years, the results were satisfactory. The mobility was complete and shortening only 4cm. and 7cm. respectively. In six cases a sinus persisted. Although there was more or less mobility of the joint with good position and the amount of shortening ranging from 6 cm. after 10 years to 26cm. after 15 years following operation, cases operated between 5 and 15 years show more satisfactory results and less excessive amount of shortening.

Patients operated at age of 15 years and above 10 cases. The results are not much different than those obtained in cases operated between ages 5 and 15 years. Of 3 cases operated for traumatic conditions, one, a woman operated at the age of 18 years and a man operated at the age of 24 years, show very good results. One man operated at the age of 22 years showed, 16 years later, a moderate result with shortening of 12 cm.

Resection of the Elbow. Nineteen cases. Four cases have not been followed up. Under favorable conditions and with the application of proper technic, resection of the elbow is capable of producing very good results. The majority of operated cases do not require any mechanical support.

Resection of the Foot. Twenty cases. In a general way it may be said that those cases operated give good results. There are some cases showing inferior results because of the fact that resection has been too extensive or because it was carried out at a too advanced age and was followed by considerable atrophy.

Resection of the Wrist. Only 2 cases of resection of the wrist are reported and both show bad results. One, a girl of 16 years, shows the hand to be dropping in the attitude of musculo spiral paralysis with ulnar deviation.

A man of 38 years who had been operated 6 months ago showed absolutely flail hand with practically no functional use.

In a general way one may assert that cases operated after the age of 15 years show the best results. In aged persons and in children the results obtained are more often bad. This is especially true of resections carried out in early infancy, especially before the age of 5 years. In those cases one finds an enormous amount of shortening, especially in resection of the hip and knee. Also a great frequency of faulty attitudes may be noticed. These are, for the hip, inward rotation with flexion and adduction, for the knee, flexion and genu varum. Genu valgum is much more exceptional.

In regard to the preservation of joint motion, this has to be considered rather a disadvantage as it favors occurrence of faulty positions. In order to obtain advantage from joint motion it is necessary to secure the co-operation of the muscular system and therefore one must study the condition of the muscles and of the extent of muscular atrophy present at first in order to judge the value of partial joint motion.—*Arthur Steindler, M. D., Iowa City, Ia.*

THE OCCURRENCE OF CLUBBED FINGERS IN HEALTHY PERSONS AS A FAMILIAL PECULIARITY. F. Parke Weber, M. A., M. D. *British Medical Journal.* Vol. 3064, Sept. 20, 1919.

Clubbing of the fingers is so well known as an acquired pathological condition in connection with diseases of the thoracic viscera that its occasional occurrence in healthy persons as a familial peculiarity deserves some attention, especially from a life-insurance standpoint.

The author reports cases of twin brothers (25 years), normal but for cluhbing of fingers. One other brother had club fingers. The parents did not have this deformity.

Another case, male, age 25, in good health, had clubbing of both fingers and toes.

Von Elselsberg (Vienna), in reporting similar cases, suggests that the condition might be lymphanglomatous nature.

Further review of the literature quoted discloses three somewhat similar cases by S. West (London).—*J. E. M. Thomson.*

THE CURE OF CRIPPLED CHILDREN. W. Horst Bateman, M. D., Ch. B., Rochedale. *British Medical Journal*, Vol. 3069, Oct. 25, 1919.

The writer wishes to record the work of the Crippled Children's Union in Rochedale. This work is managed by a general committee representing the general public, the public health and educational authorities, and with a secretary in a down-town office. They have a country hospital of 50 beds in out-of-door wards, attended by Mr. Bateman as honorary surgeon, and with a corps of nurses. A follow-up system is used, by the means of which, from history card and other detailed information, constant therapeutic attention is continued after patient leaves the hospital, and whereby visits are made and attention given even at the home of the patient.—*J. E. M. Thomson.*

FRACTURE LOWER END OF HUMERUS. A. Jeffreys Wood, M. D., Children's Hospital, Melbourne. *Medical Journal of Australia.* Vol. II, 13, 1919.

The natural forces at work in the human body to effect repair after injury are sometimes forgotten. Attention is called to the fact that Oliver, in 1867, demonstrated in experiments on animals that when the epiphysis was forcibly detached from the diaphysis of the long bone, the periosteum and part of the soft lower end of the diaphysis were carried away with the epiphysis, piercing the periosteum like a button going through a buttonhole. The new bone is formed in a sleeve of periosteum, and the bone projecting from the periosteum is eventually absorbed.

Dr. Woods illustrates these principles by the case of a child six years old who, as the result of a fall, had a compound fracture of the lower end of the humerus. Roentgen examination showed that the lower end of the humerus was displaced backward and upward, the upper fragment displaced forward and piercing the skin, making flexion beyond that of a right angle impossible. Attempts to reduce the deformity by anesthetic, failed. On account of the fact that the fracture was compound and septic, further operative intervention was deemed inadvisable.

The arm was placed in right-angle flexion and a series of roentgenograms were taken during the course of treatment. From these examinations it was found that 15 days after the accident there was marked development of bone in the periosteal bed, and a certain amount of absorption of the protruding lower end of the diaphysis which was not covered by the periosteum. Further examination 23 days after the accident showed a shaft of the bone lying behind the old diaphysis and merging into it. At this time the wound was healed and the boy carried his arm in a sling.

Four months after the injury, examination showed a complete absorption of that portion of the diaphysis which had been stripped of periosteum, and a blending of the newly formed shaft laid down in the periosteal bed. Eight months afterward the extension at the elbow joint had increased to an angle of 130 degrees, while flexion was limited to an angle of 80 degrees. Sixteen months after, the extension was increased to 160 degrees and flexion to 60, with further absorption of the old shaft. Four years after the accident, the carrying angle of the right arm was equal to that of the left, and there was apparently no interference with normal function.

In this case nature eventually straightened up the shaft of the humerus at its lower end, and the bulbous end of the diaphysis showed signs of a return to normal dimensions.

Roentgenograms in books on fractures showing this development of new bone in periosteal sleeves that have been detached from the diaphysis, have been spoken of as exemplifying longitudinal splitting of the shaft of the bone.

Epiphysial separations in children in their true sense, although still spoken of as common occurrences at the lower end of the humerus, must in the light of modern x-ray photographs be looked upon as rare occurrences. In practically all cases of so-called traumatic separation of the lower epiphysis of the humerus, part of the lower end of the diaphysis is seen involved in the lower fragment.

This is to be explained by the fact that the periosteum is very thick and strong about the junction of the diaphysis with the conjugal cartilage and epiphysis. The cartilaginous mass of the epiphysis is intimately connected with this tough periosteum. By stripping the periosteum from the shaft of the diaphysis it will be found that the removal of the epiphysis is simplified. The juxta-epiphysial region of Ollier at the end of the diaphysis is the soft spongy part of the bone uniting this latter with the conjugal cartilage. This region is the weakest part of the bone and the one which gives way first to external violence.

When a fracture occurs in this region the sharp end of the diaphysis lacerates the periosteum and goes through it like a button through a button-hole, and the lower fragment of the humerus passes backwards or forwards, inwards or outwards, carrying with it a sleeve of periosteum. The amount of stripping of the diaphysis is greater in a compound fracture than in a simple fracture.

This sleeve of periosteum then fills with blood. If an immediate attempt be made to replace the lower fragment, it is often easy to get the fragment back into its periosteal bed, and in backward separations full flexion retains the fragments in excellent position.—*Jeffreys.*

FLAT-FOOT. Lt. Col. Henry Smith. *British Medical Journal.* Vol 3063, Sept. 13, 1919.

A good deal written on the subject of flat-foot has been to show that the leg muscles attached to the tarsus were intended by nature to support and maintain the arch of the foot. The author believes this is no more the case than it is the function of the muscles attached to the carpus. The functions of these groups distinctly serve the purpose of producing joint movements of the ankle and tarsus respectively. Were muscles and ligaments required to perform the weight bearing duty, they would lengthen and become useless.

The cause of evil in flat-foot or over-high instep is found in the skeleton formation. Normally the heel and outer side of tarsus and metatarsus carry the weight of body at rest and in motion. In flat-foot the skeleton formation is such that the weight is thrown on the inner side of foot. The opposite is true in over-high instep.

The author cites the ease of a farmer in Ulster who, without education, had had such an extensive personal experience in the shoeing of crooked-foot

horses that, when examining with the author a case of flat-foot in the human, he was able to completely and classically describe a method of treatment consisting of a system of wedges in the soles of the shoes, designed to throw the weight either on the outer or inner side of the foot, as the case required.— —*J. E. M. Thomson.*

TENDON TRANSPLANTATION FOR DORSAL INTEROSSEOUS PARALYSIS. Lennox G. Teece, M. B., Ch. M. *Medical Journal of Australia.* Vol. II, 7, 1919.

The rules governing success in tendon transplantation may be set forth as follows:

1. The use of a muscle for transplantation which is as powerful as the one paralyzed.
2. For this reason, transplantation is useless in extension paralysis.
3. The transplanted tendon must be aligned so that it will exercise a direct pull from origin to insertion.
4. The tendon must be securely anchored to the periosteum or to paralyzed tendon.
5. Tendon must be sutured under sufficient tension.
6. From the time the first suture is placed until voluntary power is obtained, many weeks later, not for a single moment must a strain be allowed to fall upon it.

The case is that of a man wounded in the region of the neck or radius, severing the dorsal interosseous nerve. The disability consisted of inability to extend the fingers at the metacarpo-phalangeal joints and to abduct or extend the thumb. Prior to operation, complete mobility of all joints was obtained by massage and passive movement.

The technique of the operation was as follows: A 2.5 cm. incision was made at the level of the wrist joint over the flexor carpi radialis and its tendon and that of the palmaris longus were divided as low down as possible. A 5 cm. incision was made at the junction of the middle and upper thirds of the forearm, over the bellies of these muscles, and they were then pulled right up out of the incision and moist gauze temporarily wrapped around them. Next a U-shaped incision, with its convexity downwards, was made over the dorsum of the wrist joint and the large flap dissected up. The subcutaneous tissues were tunnelled through with a blunt dissector from the back of the wrist to the upper of the two volar incisions, and the flexor carpi radialis and palmaris longus tendons were pulled down through this tunnel and made to appear on the dorsum of the wrist. The incisions on the front of the forearm were next sutured to minimize the amount of handling and movement of the part left to be done after the transplanted tendons had been given their new attachment.

The tendons of the extensor brevis and abductor longus pollicis were divided and inserted into a slit made longitudinally in the tendons of both the radial extensors of the wrist and were there sutured under considerable tension with chromic catgut. From this moment until the final application of the splint one assistant devoted his whole attention to holding the wrist and fingers fully extended and the thumb abducted and extended. The surface of the

tendons of the common extensor of the fingers was roughened by scratching with the knife and the tendon of the flexor carpi radialis was split into two layers; one layer passed dorsal and the other volar to the common extensor tendons and there sutured firmly. The palmaris longus was similarly inserted into the extensor longus pollicis. The flexor carpi ulnaris was reached by strongly retracting the ulnar edge of the incision, divided just above the pisiform bone, brought round and inserted into the extensor carpi ulnaris. In subsequent cases I have approached the flexor carpi ulnaris by a separate incision on the volar aspect, as the method adopted in this case is apt to result in too much angling of the tendon.

The wound was closed and a long "cock-up" splint applied to insure extension of fingers and thumb. Fourteen days later gentle faradic stimulation was applied. Eleven weeks after operation complete voluntary power was restored.

Perseverance in after-treatment, especially in muscular re-education, is essential to success.—*Thomson.*

Ambulatory Treatment of Fracture of the Neck of the Femur. Dr. Edw. H. Bradford, Boston. *New York Medical Journal*, Nov. 22, 1919.

The author describes the use of the abduction splint (a modification of the Thomas knee splint to which is added a traction attachment and also a curved padded rod which gives bearing on the descending ramus of the os pubis of the unaffected side, and is bent in such a way as to secure proper abduction) in the treatment of this injury. This splint has long been in use as an ambulatory apparatus in the treatment of hip joint disease.

Fracture of the neck of the femur occurs most frequently in elderly individuals and is ordinarily followed by weeks of enforced recumbency in bed. This factor is a serious handicap in the treatment.

The author reports the case of a woman of 65, not in robust health, in which the abduction splint was applied within 48 hours of the time of injury. Ten days after the injury the patient sat up in bed. Twelve days later she was going about the ward in a walking frame, and soon afterwards became accustomed to the use of crutches. All traction was removed eight weeks after the injury and splint was worn to prevent full weight bearing until three months after injury when it was removed altogether and patient was discharged. She had neither shortening nor deformity.

As the abduction splint provides efficient fixation, the patient is able to sit up without detriment, be removed from bed and allowed greater freedom than is possible either with the plaster spica bandage or in methods of treatment in which the patient is secured by the aid of a long wooden side splint with weight and pulley traction. The fixation of the fragments and prevention of upward riding of the femur is secured by the traction. A sufficient amount of abduction can also be secured.

As great or a greater amount of fixation can be obtained with this apparatus than by the plaster spica. It produces little discomfort and permits easy use of bed-pan. Frequent radiographs can be taken. There is also the great advantage of prevention of cicatricial shortening of the periarticular ligaments

which have been injured by the original trauma and which later cause a fibrous stiffening of the joint which is overcome in convalescence with difficulty.

The abduction splint also serves as a perineal crutch as soon as the bones are sufficiently united to prevent displacement. Thereby the patient is able to walk about without any danger of injury to the nearly united fragments which are not so firmly solidified as to allow the whole body weight to fall upon them.

A plaster of Paris spica even if applied with the best of skill is extremely irksome and confining for the patient. Although the treatment is borne by the strong and healthy, its continuous use in the elderly and feeble cannot help being injurious.

The excellence of the results following the treatment of this injury by the abduction splint, a method without special difficulty in its application, would seem to warrant the recommendation of this form of treatment in a large number of cases.—*Mark Cohn, M. D., New York.*

THE DIFFERENT TENDON OPERATIONS FOR RADIAL PARALYSIS. Mauclaire. *Revue d'Orthopedie*, April, 1919, No. 413.

A comprehensive resume of the various operations of different surgeons is given in the first part of this article. It is of interest to note that the earliest of these operations is that of Drobnik in 1894, and that most of them are from 1915 on. The fact that a large majority of the surgeons quoted are European probably signifies only that the author has confined himself mostly to the literature of the other side. Criticism of the principle of some of these operations is given. The transfer of tendons through the interosseous space sacrifices too much muscle of the anterior group. Transplantation of the palmaris longus and the flexor carpi ulnaris into the shortened tendons of the extensor communis digitorum is a logical procedure. Simple shortening of the dorsal tendons or transplanting them into the bones or periosteum of the metacarpals is not sufficient as it merely holds the hand up and does not mobilize the wrist or the fingers. It is necessary in all cases to take the peritendinous tissue with the tendon itself in order to preserve the gliding surface.

The author's technic is as follows: The tendons of the palmaris longus and brevis and of the flexor carpi ulnaris are exposed by a horseshoe incision on the anterior surface of the wrist. Through a second horseshoe incision on the back of the hand the common extensors are exposed and shortened if necessary (usually not more than one centimeter). The palmaris tendons are then brought around the radial side of the wrist and sutured to the two external common extensor tendons and the flexor carpi ulnaris around the ulnar side of the wrist to the dorsum of the hand where it is sutured to the two internal tendons of the common extensor. This technic may be varied by suturing the palmaris tendons to the long extensor of the thumb in addition to the two external common extensors.

Six cases are reported in which this operation was done with more or less improvement in every one. The average time after onset at which operative treatment should be given is about one year. One should not wait too long for the extensor tendons will become over-stretched and lose their elasticity, the

flexors will become too short and contour of the carpal bones will have been changed. The ultimate result is usually a slightly hyperextended position of the hand, complete flexion not being possible.—*William Arthur Clark.*

EXTERNAL LUXATION OF THE PATELLA. Murad. *Revue d'Orthopedic*, April, 1919. No. 435.

The author reports one case and discusses the mechanics of dislocation of the patella. The patellar tendon must necessarily be elongated in order to permit the bone to slide out over the femoral condyle. A long tendon may be a congenital condition. It is also necessary that the knee be twisted so that the tibial tuberosity is displaced outward. In this short interval when the leg is sharply in external rotation on the knee, the patella slips over the external condyle. The leg resumes its normal position but the patella is caught in the outer groove under the external condyle and held there by the tension of the overstretched tendon.

The case reported is a man aged 28, who had had a twisting injury to the same knee seven years before. The patella was dislocated outward when he made a sudden musclar effort to resist falling as his foot went into a depression in the uneven ground where he was exercising. He fell and had to be transported to a hospital. The patella lay outside the external condyle and could be grasped between thumb and finger, the posterior surface being palpable. It was easily reduced under ether by making pressure on its outer border so that the inner border slipped up and over the condyle. A hemarthrosis had to be aspirated in forty-eight hours, but in eight days the patient left the hospital. The injury seven years previous is said to have been a predisposing factor in this case. The reduction must be done without violence in all cases.—*William Arthur Clark.*

ADEQUATE REDUCTION AND CARE IN COLLES' FRACTURE. NEW METHODS. By Frederic J. Cotton, M. D., Boston. *The Boston Medical Journal*, Vol. CLXXXI, No. 23, December 4, 1919.

When one breaks his wrist, it is the radius that gives way, but the whole damage may best be expressed as a rotation backward of the hand about the ulnar head as a fixed point, a rotation which tears the ulnar ligaments loose and also breaks the radius. The hand is displaced, with the radial fragment, up and back in toto, to a varying degree—often great; but, whatever the total displacement of broken fragments, always the hand is displaced backward,—always the associated tilting backward of the lower radial fragment.

If the ulnar is the fixed point about which the hand is displaced, make it the fixed point about which one reduces; if the hand is displaced in extension, reduce it in flexion; if it is displaced in rotation of supination about the ulnar head, reduce in pronation.

After the obvious displacement of the radius is corrected, then carry the hand about the ulnar as a fixed point into pronation and flexion.

A good deal of force is directed up under the ulnar head, a strong drag flexes the hand, and a twist of the whole hand about the ulna finishes the

work. This may all be done as one twisting sweep—and easily, rarely needing repetition.

The average splints are very often inefficient. The muscle tonus holds the fragments against redisplacement in toto, but not against rocking back of the distal fragment, the more so as there is often enough crushed and missing bone at the edge of the fracture to leave a gap.

This can be done only in flexion, and flexion is best held in plaster, preferably applied as strip-splints of eight to ten layers of plaster-of Paris bandage, one on the back, from elbow to finger knuckles, one in front, from upper forearm to palm. These are caught with a few turns of plaster-of-Paris bandage.

So long as the wrist is in flexion, the posterior ligaments always intact, gives the pull that keeps the distal radial fragment from rocking backward; and so long as the ulna is held to the back of the flexed wrist, the ligaments can heal to something near their normal length. This is important, for not only is there weakness in the ligaments, but their laxity often permits a subluxation of the ulna with each supination,—a common factor of disability.

Use straight splints with exaggerated pads for a third week and then a supporting strap of adhesive with a pad in front of the ulna.—*Leo C. Donnelly, Detroit.*

THE SIGNIFICANCE OF FOOT TROUBLES AND DEFORMITIES. By J. Madison Taylor, A. B., M. D., Philadelphia. Professor of Applied Therapeutics, Medical Department, Temple University. *New York Medical Journal,* Vol. CX, No. 18, November 1, 1919. Whole No. 2135.

Among the most cherished privileges of human liberty is to deform the feet. So serious do the effects become that a large proportion of heterogeneous miseries are not only increased by foot defects but many are caused by them alone.

Popular attention has fortunately been directed to foot defects among civilians by recruiting and the rejections which they caused. This is now becoming mercifully reflected on the entire problem of foot wear and the choice of shoes. The more progressive shoe merchants realize that men, at least, are coming to their senses and will hereafter refuse to suffer from distortion and displacement of their feet.

The chief objects to be achieved in the repair of acquired foot deformities are the following:

1. The release of contractures whenever and wherever present in feet or plantar fascia and posterior muscles of the leg, or restriction in flexion or foot action.

2. Rest for the impaired, toneless, overstressed muscles concerned in body weight bearing, also economies in the distribution of the load upon these subnormal structures.

3. Rotation of the calcaneum into its normal position, so that it is held comfortably in position but without interfering with the integrity of the plantar fascia or interossei or other muscles concerned in foot function, the chief of which is prehension.

4. The astragalus forms the keystone, the two limits of the arch being the os calcis posterior, and the astragalus anterior. A foot that has only a low arch, but which is able to flex or grasp, and which under weight bearing does not abduct the foot, is a good foot and useful for all purposes. A foot that looks apparently normal when off the ground but which shows an inner convexity at the astragalo-scaphoid joint, with abduction of the foot during weight bearing, is a weak foot and generally useless. A foot which when off or on the ground shows an inner convexity at the astragalo-scaphoid joint with abduction of the foot is a real flat foot and qualitatively dangerous.

5. Restoration to normal attitudes and adequate tone of the body as a whole, in order to attain and maintain the economies of weight bearing and locomotion. The pelvis should be level, i. e., thirty degrees from the horizontal. This is more important while standing, because then the greatest tension stress is maintained.

6. While in this correct standing posture, the toes may be turned out to widen the base, but it is better to throw the weight on the outer surfaces of the foot and to widen the distance between the feet.

7. Locomotion, gait and walking action should be carefully revised. The foot should be placed firmly down with the weight evenly distributed between the extensors and the flexors, so that the gait is an equitable mixture of push and pull. Avoid lurching forward, or an alternate dipping down and straightening up as this causes waste motion, and loss of power in the effort to rise and overcome the prop which is equal to several foot pounds.

While walking it is most important to turn the toes in and to acquire the habit of throwing the weight on the outer surfaces of the feet; to use both the flexor and extensors in each leg alternately; to pull back with the flexors immediately and fully, as soon as the extensors are released. In this way the knees are kept straight, i. e., the thigh and leg are retained in a direct line as the leg comes back. It is also desirable to place the whole foot—heel, ball and toes—down together and not to rest the weight on the anterior portion of the foot.—*Leo C. Donnelly, Detroit.* No man could run that way!

Working Capacity of the Disabled Man. Editorial *Lancet*, October 11, 1919.

Taking cognizance of the fact that over 5% of the total of British workers were disabled through war service the editor comments on the possibilities of proper employment for those whose former capacities have been reduced or destroyed. A very large percentage of those still remaining unemployed were unskilled.

He suggests that the duty of those who employ such, begin with those who employ ten or more laborers and be carried on up in the proper percentage. He cites the probable difficulty arising from unrest in event that a partially disabled man were to be paid the same as another laborer for a less amount of work, and consequent tendency of the able worker to cut down his production, and adds, that he who received no injury must be patriotic enough to bear with his unfortunate co-worker until he finds the sort of work at which he can reach the maximum of his ability to produce, in the type of work for which he can develop the most skill. He suggests that there are many medical men espe-

cially in this country who could use some of the disabled. The burden lying on the public is to do all that is possible to get the unfortunates to earning before they become discouraged and permeated with the idea that they should live the remainder of their lives on compensation.—*James R. Elliott, Kansas City, Mo.*

ANKYLOSING OPERATIONS WITH TUBERCULOUS SPINE. Leonard W. Ely, San Francisco, Cal. *Annals of Surgery*, December, 1919.

The author reports a case of Potts disease of the tenth dorsal vertebra, upon which a Hibbs ankylosing operation was performed. Two months later a second operation, a bone grafting, was done, as the Hibbs procedure did not secure fixation at one or two points. Four months after the second operation the child died of meningitis.

Examination of the specimen showed disease of the eighth, ninth and tenth dorsal vertebrae, and the spine was prevented from collapsing by the bony bridge of the laminae. The disease progressed in spite of the fixation of the graft.

The conclusions drawn from eight years of observation are:

1. These ankylosing operations are curative in a large proportion of cases of what was previously an incurable disease.

2. These operations provide rest for the diseased area and thus place Nature in the most favorable condition for a cure.

3. These operations greatly reduce the length of treatment and make it simplified.

4. Seriousness of the operation should be considered in view of the mortality figures and dangers of anaesthesia.

5. The author has never had a separation of the graft in his cases.

6. The author prefers the Hibbs operations except in the lordotic lumbar spine, although the Hibbs procedure takes longer and is more difficult.—*Curtis Lee Hall.*

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The Journal *of*
Orthopædic Surgery

THE OPERATIVE CORRECTION OF PARALYTIC VALGUS*

S. KLEINBERG, M. D., NEW YORK.

*Paper read and cases presented before the Alumnae Association of the Hospital for Ruptured and Crippled, December 29, 1919.

One of the most frequent if not the most frequent complication of Poliomyelitis is permanent paralysis of the tibialis anticus muscle, combined often with paralysis or weakness of the tibialis posticus, resulting in a valgus or equino-valgus deformitory.

During weight bearing the foot in a case of paralytic valgus is in a position of abduction in relation to the leg, and the long arch is depressed or completely obliterated. If both tibiales are paralyzed, the valgus is marked, the astragalus is rotated downward and inward, and the head of the astragalus projects prominently on the inner side of the foot where a large callus appears very early. When the anticus alone is paralyzed the foot is in equinus with a varying degree of valgus. The arch of the foot is depressed usually only during weight bearing, the head of the astragalus is not prominent and is rarely covered by callus. Whether one or both of the tibiales muscles are paralyzed, if the condition is not corrected, the tendo achillis and the peronei tendons become contracted, a rigid valgus or equino-valgus develops and the patient walks with a marked limp.

If such a patient is seated and asked to dorsi-flex the affected foot, he brings it up in a position of valgus, the common extensor tendons, the tendon of the extensor proprius hallucis and that of the peroneus tertius stand out prominently, while the tibialis anticus tendon is not visible. The patient is rarely able to dorsi-flex to a right angle. When he can do so, the foot is in a position of extreme valgus for which the peroneus tertius, a small and otherwise unimportant muscle, seems to be to a considerable

degree responsible. During the attempt at dorsi-flexion, it becomes apparent that the valgus is due primarily to the absence of power on the inner side of the foot, and also to the outward pull of the extensor tendons, especially the peroneus tertius.

To correct this condition we have been doing two types of operations. One is the "Loop" operation devised by Dr. Whitman. This consists of displacing the extensor tendons inward so that when they act they will pull the foot up in a median line in relation to the leg, instead of in abduction. The other operation is a transplantation of one of the peronei muscles, preferably the longus, to the inner side of the foot to take the place of the paralyzed tibialis.

"Loop Operation."

The Loop operation is performed in the following manner. A median incision about five inches long is made over the front of the foot, ankle and lower part of the leg. The annular ligament directly below and in front of the external malleolus is cut. This permits separation and elevation of the extensor tendons en masse from the underlying structures. The peroneus tertius is then cut at its attachment. This permits displacement of the extensor tendons inward. The displaced tendons are held in their new position by the tibialis anticus tendon which is looped about them and hence the name of loop operation. The tibialis anticus tendon is cut about 1½ inches above the ankle joint and the distal part about three inches in length, is pulled out of its sheath. It is passed from within outward behind the extensor tendons, and is then brought forward and inward in front of the extensor, and is finally implanted into the substance of the tibia according to the Gallie technique.

Before implanting the tibialis anticus tendon, an incision is made over the external aspect of the leg and ankle from about the middle of the leg to the base of the fifth metatarsal. The peroneus brevis is isolated, cut at its attachment, pulled out without cutting the external lateral ligament of the ankle joint, dissected up a sufficient distance, transferred through a subcutaneous tunnel to the inner side of the leg and passed down through the sheath of the tibialis anticus tendon to the inner side of the foot. The tendon of the extensor proprius hallucis is cut opposite the first metatarso-phalangeal joint, and together with the tendon of the

peroneus tertius is brought to the inner side of the foot. The tendons of the peroneus brevis, extensor proprius hallucis and peroneus tertius are then sewed together and implanted at the site of attachment of the tibialis anticus, preferably by a suture that goes through bone. The tendons are sutured very securely, and the site of attachment is covered up whenever possible by a layer of subcutaneous tissue.

If the foot cannot be brought to a right angle or very near a right angle without much effort, the tendo archillis is cut. The wounds are then closed, and the limb is encased in plaster with the foot in adduction and at a right angle to the leg.

The other operation we have used for the correction of paralytic valgus is a combination of transplantation of the peroneus longus to the inner side of the foot through the sheath of the tibialis anticus, and implantation of the tibialis anticus tendon into the tibia. The object of the transplantation is to supply an active muscle on the inner side of the foot. It is transplanted, according to the Biesalski-Mayer method of physiological transplantation of tendons, through the sheath of the tibialis anticus. In order to prevent adhesion of the transplanted tendon to the surrounding structures as it passes across the front of the leg I have adopted the suggestion of Dr. Leo Mayer and establish a fascial bed. This is accomplished by suturing the adjacent layers of the sheaths covering the peronei and tibialis anticus tendons so that their synovial surfaces face forward and are in contact with the transplanted peroneus longus as it crosses the leg.

The tibialis anticus tendon is implanted into the tibia to act as a check to abnormal plantar flexion and abduction. This is accomplished by cutting the tibialis anticus tendon a short distance above the ankle, and pulling the distal part, usually about two and a half or three inches long out of its sheath. It is then passed upward under the annular ligament of the ankle and implanted into the tibia. It is passed under the annular ligament so that it is made to conform to the curve of the ankle instead of standing out prominently as a cord across the inner aspect of the joint. This last procedure was suggested to me by Dr. Arthur H. Cilley.

Report of Cases.

1. Sylvia T., 7 years old. Paralyzed in 1916. Right paralytic valgus. Paralysis of both tibiales muscles. Operation April 28, 1919. Transplantation of peroneus longus. Achillotomy. Tibialis anticus not implanted.

December 15, 1919. Foot in normal position. Can dorsi-flex beyond a right angle with foot in median line. Foot is in median line during weight bearing. The transplanted muscle is strongly active.

Result: Excellent.

2. Edward M., 7 years old. Paralyzed in 1916. Left paralytic valgus. Paralysis of tibialis anticus; posticus is active. Operation June 30, 1919. Transplantation of peroneus longus. Fascial plastic. Achillotomy. Tibialis anticus not implanted.

December 16, 1919. Foot is in median line. Dorsal flexion to 110 degrees. The transplanted muscle is active. During weight bearing the foot is in the median line.

Result: Excellent.

3. Milton B., 7 years old. Left paralytic equino-valgus. Paralyzed in 1916. Tibialis anticus paralyzed. Tibialis posticus active but weak. All the other dorsal flexors are weak.

Operation September 8, 1919. Transplantation of peroneus longus. Fascial plastic. Tibialis anticus tendon implanted into tibia.

December 15, 1919. Foot is in equino-varus. In standing position the foot is in normal relation to the leg. There is slight power of adduction through the flexor longus hallucis. No power of abduction. The implanted tendon is effective as a check ligament preventing abnormal plantar flexion or abduction. The transplanted peroneus is not active. Mother states that boy is improved because he stands better and does not fall as much as he did before the operation.

Result: Improved.

4. Sadie S., 6 years old. Left paralytic valgus. Paralyzed in 1916. Tibialis anticus is paralyzed. Other muscles about the ankle are active.

Operation November 1, 1919. Transplantation of peroneus longus. Fascial plastic. Tibialis anticus implanted into tibia. De-

cember 15, 1919. Foot is in equino-varus. Can dorsi-flex to a right angle. Foot goes into slight valgus during dorsal flexion. The transplanted muscle can not be felt to contract. During weight bearing foot is in median line. The arch of the foot is high and the original deformity is entirely corrected.

Result: Improved.

5. Ida W., 9 years old. Left paralytic equino-valgus. Paralyzed in 1916. Both tibiales muscles are paralyzed. Other dorsal flexors are so weak that there is no active dorsal flexion.

Operation October 6, 1919. Transplantation of peroneus longus. No fascial plastic. Tibialis anticus implanted. Tendo achillis not cut. Foot put up in plaster in 100 degrees of plantar flexion.

December 17, 1919. Foot in equino-varus. Cannot dorsiflex. Definite resistance to abnormal plantar flexion and valgus. Transplanted tendon not active. Child walks better than before the operation.

Result: Improved.

6. Sylvia L., 3½ years old. Left paralytic equino-valgus. Paralyzed in 1916. Foot is in rigid equino-valgus. Both tibiales muscles paralyzed.

Operation April 21, 1919. Transplantation of peroneus longus Fascial plastic. Achillotomy. It is doubtful if peroneus tendon passed through sheath of tibialis anticus.

September 28, 1919. Child walks better. Foot still goes into valgus during dorsal flexion, but not to the same degree as before the operation.

Result: Improved.

7. Henry U., 6 years old. Left paralytic equino-valgus. Paralyzed in 1916. The tibiales muscles are paralyzed. The other muscles are so weak that we are dealing with practically a flail foot.

Operation, May, 1919. Transplantation of peroneus longus. Implantation of tibialis anticus.

December 17, 1919. Foot is in equino-varus. Definite restriction to abnormal flexion and abduction. Slight power in the transplanted muscle. Mother thinks he is better because he walks better.

Result: Improved.

8. Frances L., 4 years old. Left paralytic valgus. Paralyzed in 1916. Paralysis of both tibiales.

Operation. Transplantation of peroneus brevis.

December 16, 1919. Foot is in less valgus than before the operation. Foot still goes into valgus during dorsal flexion. He walks much better than he did before the operation, and with his shoe on, the foot stays in varus.

Result: Poor.

9. Max K., 4 years old. Left paralytic equino-valgus. Paralyzed in 1916. Tibialis anticus is paralyzed; other muscles are active.

Operation January 31. 1919. Transplantation of the peroneus longus.

Post-operative course. Foot through oversight was kept in plaster for six month. At the end of this time the foot was found in a position of marked and resistant varus. The foot was then placed in plaster in neutral position for one month, after which the patient left our clinic.

December 20, 1919. Foot is in extreme varus. Walking is awkward and very poor. No active eversion of foot. Dorsal flexors practically paralyzed.

Result: Failure.

A review of the above cases shows that the transplantation of the peroneus longus, especially if combined with implantation of the tibialis anticus will produce an improvement in about 70% of the cases. In some of the cases, as in the first two of this series, the result will be excellent. We must realize, however, that we cannot obtain a perfectly normal foot because we cannot reproduce the normal muscle balance about the ankle. At best we should only expect a correction of the deformity and an improvement in function. Moreover, the peroneus longus which is normally not as strong as the tibialis anticus cannot be expected to do the work of the latter, especially when it is compelled, as in this operation, to pull over an irregularly curved line running from the upper and external part of the leg across the front of the leg and down to the inner aspect of the foot. However, careful attention to details may improve our results.

The following points are worthy of emphasis:

1. The peroneus longus is preferable to the peroneus brevis for transplantation because it is longer and stronger than the brevis.

2. The peroneus muscle should be dissected free as far as possible so that the line between its origin and its site of attachment will be as nearly as possible a straight line.

3. The peroneus tendon should be passed through the sheath of the tibialis anticus so that its pull will imitate that of the tibial muscle.

4. The transplantation should be reinforced by an implantation of the tibialis anticus tendon. This is extremely important. In my earliest cases when the anticus was not fixed to the tibia it was noticed repeatedly that the foot after operation relapsed into equino-valgus. The fixation of the anticus tendon effectively overcomes this. The implanted tendon must not, on the other hand, be implanted so that it holds the foot at less than a right angle or in extreme varus, as that would make walking very awkward.

5. Fascial plastic. Theoretically it seems reasonable to expect that adhesions will be less likely to occur when the tendon passes over a synovial bed. Nevertheless, we frequently see tendons transplanted in subcutaneous tissue move very freely.

6. The ideal case for the above operation is one in which the tibialis anticus alone, or both tibiales are paralyzed, but in which the other dorsal flexors and especially the peronei are strongly active.

7. The post-operative care should include in addition to muscle training and massage, support of the foot in the adducted position by using during the day a shoe raised on the inner side, and at night a splint that will hold the foot at a right angle and in adduction.

CASE NO. 10. Sadie R., 10 years old. Left paralytic equino-valgus. Paralyzed in 1916. Paralysis of the tibialis anticus. Other muscles including the tibialis posticus, are active.

Operation August 4, 1919. Loop operation.

December 12, 1919. Foot is in slight varus. She can dorsiflex to a right angle with foot in median line. Transplanted muscle is active. There is no resistance to full plantar flexion, so that attachment of implanted anticus tendon has loosened or was not made

sufficiently taut. During weight bearing foot in normal position. Can adduct foot, motion being due to action of peroneus brevis and tibialis posticus.

Result: Excellent.

CASE NO. 11. Abraham B., 5 years old. Right paralytic valgus. Paralyzed in 1916. Paralysis of both tibiales muscles. Other muscles active.

Operation October 16, 1919. Loop operation.

December 15, 1919. Can dorsi-flex to a right angle which he could not do before. During dorsal flexion foot remains in median line. During weight bearing foot is in median line. Transplanted peroneus brevis is active.

Result: Excellent.

CASE NO. 12. Sylvia T., 7 years old. Left paralytic equinovalgus. Paralyzed in 1916. Both tibiales muscles are paralyzed. Other muscles are active.

Operation November 7, 1919. Loop operation.

December 17, 1919. Can dorsi-flex, holding foot in median line. Abnormal plantar flexion and abduction restricted. During weight bearing foot is in slight varus.

Result: Excellent.

CASE NO. 13. Agnes McG., 13 years old. Right paralytic varus. Paralyzed 1916.

Operation September 3, 1919. Loop operation.

December 16, 1919. Foot is symmetrical, though flat. Can dorsi-flex to 80 degrees. Plantar flexion is limited to 110 degrees. Further plantar flexion is limited by the scar of the anterior wound and the implanted tendon. During walking the foot is in moderate valgus.

Result: Good.

A review of the last four cases shows that the Whitman Loop operation when properly performed yields excellent results. It corrects the original deformity, and causes a marked improvement in the function. In this series of four cases the choice of cases for operation was a more fortunate one than in the preceding nine cases in which the transplantation was done. In every one of the four cases all the muscles with the exception of the tibiales were

strongly active, while in the series of nine transplantations the dorsal flexors and peronei were often very weak.

The important points in the successful performance of the "Loop" operation are: First, thorough separation of all the extensors from the front of the ankle and foot, and their displacement inward. Second, separation of the tendon of the peroneus tertius from its attachment at the base of the fifth metatarsal. Third. Implantation of the tibialis anticus tendon.

It is interesting to note that the transplanted peroneus brevis was active in every one of the "Loop" operation cases, while in the series of transplantations, the peroneus longus was found active in only three of the nine cases. It is difficult to explain this difference.

There are several important considerations that relate to both operations.

FIRST: The ideal case for correction by either of these operations is one in which the tibial muscles are paralyzed, and the other muscles about the ankle are strongly active.

SECOND: It is necessary to examine the function of the foot very carefully before operation so that we may be able to judge the post operative results accurately. We should note whether the anticus alone or both tibiales muscles are paralyzed. We should also investigate the function of the other muscles about the ankle and learn to what extent each group of muscles is active.

THIRD: Prolonged over correction, as in one of this series, may be harmful. Five to six weeks in plaster after either operation is sufficiently long to allow the parts to become firmly united.

FOURTH: In implanting the tibialis anticus, the tendon should not be so taut as to hold the foot flexed to less than a right angle. For if firm healing takes place with the foot in this position, the mobility of the ankle will be seriously restricted, and walking will be difficult and very awkward.

FIFTH: The transplanted tendons must be sewed so securely that there will be no danger of slipping. The suture should, if possible, go through bone, and should be covered by a layer of subcutaneous tissue.

APPLICATION OF CURATIVE THERAPY IN THE WARD

BY HENRY CHASE MARBLE, BOSTON.

During the war the Government added to the resources of the Base Hospitals in France an aid to treatment, administered thru the Reconstruction Aides. During the past few months the terms have crept into use; Occupational Therapy, Physio Therapy, as if each were an end unto itself, each the only factor necessary to heal the wounded man. This is a serious mistake. Let us not be led astray from the object of the Medical Corps even in thought and talk of this therapy and that therapy but let us unit them all under a competent surgeon, pool all the resources and make towards a successful whole. Any work aside from ward work with wounded soldiers will not be included in this paper and the means and methods only that were used in Base Hospital No. 6, A. E. F. will be recited.

In direct charge of all medical and surgical work is the surgeon, either the ward surgeon or the Chief of Department. At his disposal are various resources, the nurses, the orderlies, and the aides. The work of the nurses, their devotion to duty and brilliant work is well known to this association, and the assistance of enlisted men of the Medical department was valuable and intelligent, but it will be my scope to tell of the work of the Aides, occupational and physical.

Occupational Aides

The occupational aide working under the direction of the ward surgeon strives thru simple and graded occupation, first for mental rehabilitation, second for restored function. Were the soldier well and back with his regiment, the process would be called establishing morale, but in wounded men it must be called mental rehabilitation. During this period active medical or surgical treatment is going on.

The direction of the medical officer is necessary in order that the correct amount of work shall be given. Often the men most in need of occupation are the hardest to start and afterward to keep busy, often a man doing very little work requires more, and rarely a man is doing more than is required and must be slowed

down. This is the work of the ward surgeon, and is a necessary and important detail of the after care.

Later when the patient is up in the wheel chair or about the ward on crutches, some attempt may be made towards functional restoration, again always under careful and minute supervision of the medical officer. Occupational therapy is a therapeutic resource, an assistant to after care and must be used by the medical officer as such. If he does not give it the time it requires, it fails to fulfill its purpose. As Dr. Blake said here a few days ago: "It is the man behind the splint." So in this work, it is the man behind the treatment.

Physio Ward Work

The work of the physio aide is of quite another type, but at the same time is under the immediate direction of the medical officer. Her function is to prevent deformity, to stimulate and encourage active motion, to direct and aid muscle re-education. Patients with large compound fractures were benefitted by massage and motion of adjacent joints while atrophy of the neighboring muscles was diminished. All of the work was done in the wards and careful records kept of improvement. In cases with only muscle wounds, after closure, early motion and rapid return to active work was the policy. The barometer of motion being always pain.

In Base Hospital No. 6 the daily ward visits included beside the ward surgeon or Chief of Department, the nurse, the enlisted man, who acted as splint man, and the two aides, occupational and physio. At each wounded soldier's bed the nurse reported upon the progress of the wounds and general condition; the enlisted man was on hand to adjust and rearrange the splinting; the physio aide demonstrated the muscle and joint progress; and the occupational aide showed the progress in her work. The type of occupational work found most suited for bed patients was rug making, toy making, weaving, stenciling, printing and bead weaving.

We had, because of short personnel, the opportunity at one time to compare wards in which the reconstruction aides were and were not at work, wards containing the same type of cases, wards all under the care of the same surgeon. In every case the verdict

was overwhelmingly for the reconstruction aides, a verdict not only of physical progress, but also a verdict of moral progress.

There is one further method which is closely allied with this ward work that I have found of great value. It is the application of new measuring devices to ward work, methods of fairly accurately measuring joint function. Let us now put aside old inaccurate guess methods and substitute accurate methods of measuring. Simple devices can be elaborated so that every body motion can be measured. By charting these figures, the wounded soldier follows with great interest and delight, his return to normal function.

These are simple copper or wooden frames that fit over or about the limb and are fitted with a dial and pointer. Upon this dial is recorded, after applying the apparatus, the extent of flexion or extension, the degree of abduction and adduction. These give fairly accurate readings that can be charted graphically. For instance a soldier with limited extension of the elbow, watches with keen interest the weekly measurements from 90 degrees to 100 degrees to 120 degrees, etc., out to normal. It puts aside old methods of guess and approximation and substitutes a method of accuracy.

*INTERURBAN ORTHOPEDIC CLUB

MONTREAL, CANADA, NOVEMBER 21st, 22nd, 1919
NOVEMBER 21, 1919

Leave for St. Annes' Military Hospital C. P. R. Windsor Station, 9 A. M.
9:45 Meet Col. Camerson, C. M. G.

10:15 Lt. Col. Turner, M. C. .... Tendon Grafts
10:45 Capt. Patterson .... Pneumococcic Arthritis
Major Gurd .... Empyema Surgery
Capt. Lamb .... Physiology of Remedial Gymnasium
Capt. Sims .... Functional Deformities
Capt. Gilday .... Un-united Fracture of Tibia
1:00 P. M. Lunch. Officers' Mess.
2:00 P. M. Capt. Henderson .... Rectal Anaesthesia
Major Risdon .... Plastic Facial Surgery
Capt. Campbell, C. A. D. C. .... Dental Splinting and Mechanical Restorations
Lt. Col. Turner, M. C. .... Amputation Stumps
4:40 P. M. Major Pirie .... Supernumerary Bones of Foot
7:15 P. M. Dinner. University Club.

MONTREAL GENERAL HOSPITAL, NOVEMBER 22, 1919.

9:30 A. M. Demonstration of Amputations of the Lower Extremities with Presentation of Cases, Capt. Fraser Gurd, R. A. M. C.
10:00 A. M. Conservative Treatment of Acute Suppurative Arthritis with Illustrative Case, Capt. Fraser Gurd, R. A. M. C.
10:20 A. M. The Care of the Bladder in Cases of Paraplegia Following Fracture of the Spine, Col. J. M. Elder, C. M. G., C. A. M. C.
10:50 A. M. War Injuries of the Bone—Destruction, Regeneration and Repair, Major L. J. Rhea, C. A. M. C.
11:10 A. M. Clinical Deductions from Bone and Joint Specimens of the Canadian War Museum, Lt. Col. A. T. Bazin, D. S. O., C. A. M. C.
11:50 A. M. Plates Illustrating Oxygen Injection of the Abdominal Cavity for X-Ray Diagnosis, Capt. W. A. Wilkins, C. A. M. C.
12:10 P. M. Fractures of the Femur in War. Deductions made from the Treatment of 1,000 Cases. Lt.-Col. F. J. Tees, M. C., C. A. M. C.
12:40 P. M. Capsulorrhaphy of the Shoulder Joint with Shortening of Coracoid Process for Recurrent Dislocation of the Shoulder, Dr. J. A. Nutter.
1:00 P. M. Lunch as the guests of the Management of the M. G. H.

If time will permit, Lt. Col. Mackenzie Forbes will give a series of demonstrations on living patients illustrating methods of treatment practiced in the Orthopaedic Service of the M. G. H.

*Although late, the above program and a few paragraphs from the proceedings are presented because of their special interest.

CHILDREN'S MEMORIAL HOSPITAL, NOVEMBER 22, 1919.

2:30-3:00 P. M.	Demonstration of the Gymnastic Treatment of Scoliosis, by Rotation, Miss Asplet and Miss Torrance.
3:00-3:20 P. M.	Pressure Paralysis with Illustrative Case, Dr. A. A. Robertson.
3:20-3:40 P. M.	A Series of Cases Illustrating the Results of Operative Treatment of Claw Foot and Anterior Metatarsalgia, Dr. A. Mackenzie Forbes.
3:40-4:00 P. M.	Congenital Lues with Illustrative Cases, Dr. H. Rupert Derome.
4:00-4:20 P. M.	The Sequelae of Epidemic Meningitis with Illustrative Case, Dr. H. B. Cushing.
4:20-4:30 P. M.	Excision of the Knee in Children for the Maintenance of Stability Following Paralysis, Dr. A. Mackenzie Forbes.
4:30-5:00 P. M.	The Complications and the Sequelae of the Severe Forms of Scoliosis, Dr. H. B. Cushing.
5:00-5:20 P. M.	The Operative Treatment of Scoliosis with Illustrative Cases, Dr. A. Mackenzie Forbes.
5:20 P. M.	Departure for the Royal Victoria Hospital.
5:30 P. M.	Royal Victoria Hospital. New Building.

NOVEMBER 21, 1919, ST. ANNE'S MILITARY HOSPITAL.

Address by Col. Cameron.

Col. Cameron stated that in the Canadian Army there were finally 541,000 men, only 83,000 of these were conscripted and 465,000 volunteers. The Canadian Medical Service had about 31,000 beds overseas and treated over 500,000 cases. The Military Hospitals' Commission at present is known as the Soldiers' Civil Re-establishment Bureau, whose chief function was to step in after the Army Medical Department had ceased treatment of cases, because in 1918 it was found that the original Hospitals' Commission was impractical apart from the regular Army Medical Department who finally took the work over, providing about 17,000 beds in Canada. In Montreal, the center at St. Anne's has been the main facial center and the chief neurological center. The facial center is soon to be moved to Toronto. The chief Orthopaedic center, one of four, is in Toronto. The hospital at St. Anne's comprises a total capacity of about 1,000 beds with excellent equipment. It is probable that early in the year 1920, the whole hospital will be handed over to the Soldier's Re-establishment Commission and the Army Medical Department will cease to have direct control.

After Col. Cameron's address, Lt. Col. William G. Turner showed numerous cases of tendon transplantations chiefly for musculo-spiral paralysis. He stated that they had come to the conclusion that it was not worth while to wait after a year for musculo-spiral recovery but to do tendon transplantation at once. They often, when tendon transplantation is decided upon, do a nerve exploration first for the sake of data concerning pensions. They have come to the conclusion that the studies of the sensations are not of great value. They have found apparent return of sensation but at exploration a very wide space

between nerve ends. In cases of non-union of ends, where there is a bad scar, they have followed the plan of excising the scar first, and two or three weeks later doing the bone graft, always preceded by an injection of 1,500 units of anti-tetanic serum.

Capt. Sims discussed the treatment of functional cases and their diagnosis. The organic cases were not considered. The two classes which it was important to differentiate, he considered to be the reflex nervous cases and the hysterical cases. In the reflex nervous cases the deformities are characterized by atrophy of the muscles generally above the injury. The affected limb has the lower temperature. Electric reactions are somewhat diminished, but there is no reaction of degeneration. The vasomotor disturbances consist of the blood pressure being lower in the affected limb, the tendon reflexes being increased but are never exaggerated as in hysteria. These reflexes remain increased under deep anesthesia which is not true of hysterical cases. The treatment which he had found most useful was by hot water and Faradic baths and considers that very few completely recover. For the hysterical cases, he considers the treatment should be psychotherapeutic in some form. Often a demonstration by electrical contraction will persuade the patient of his ability to move the limb.

Col. William G. Turner gave his conclusions as to the points of election for amputation. He believed that amputations of the foot gave serviceable stumps if in front of the mediotarsal joint. He considers that the Chopart was unsatisfactory because of the subsequent pull of the tendo Achillis. He believed the Symes to be extremely satisfactory. He said that the amputations in the lower third of the leg have been a great disappointment and very unsatisfactory. They are subject to abraisons, circulation is poor and they all suffer in cold weather. He considers amputation through the knee joint unsatisfactory, because of the flare of the condyles and difficulty of fitting an inconspicuous appliance. The Gritti-Stokes he considers satisfactory with cat gut or aponeuritic suture. He thinks the antero-posterior scar of the thigh is better than the lateral or transverse scar.

Dr. Teese talked about fracture of the femur. Dr. Teese had had a chance to observe and take part in the treatment of 1,000 cases. In most of the hospitals they were treated by the Thomas splint, which was attached to the leg, and then tied securely to the foot of the bed, the foot of the bed being raised 6 to 8 to 12 inches, and the splint suspended from the ceiling, with the ropes pulling in such a direction that they also helped in the extension. A portable X-ray machine was used, and the plates were taken in two planes every two weeks. Skeletal traction was found to be far preferable to skin traction. They used Beesley's caltper, or some similar caltper. If the fracture was in the lower third of the femur, callpers were put well forward on the condyle. In all the many hundreds of cases in which calipers were used, damage was done in only three by slipping. In the control of sepsis, they depended upon (1) efficient traction, and (2) free incision, rather than upon Carrel Dakin. The incision was in the muscle plane between the extensors and the hamstrings, i. e., an external lateral. Hemorrhage was controlled by efficient traction. In regard to the use of Sinclair glue, they found it to be excellent in many cases, but it should not be used with picric acid, because it blisters. Where it was

necessary to lengthen the femur after loss of substance, a notch slipping operation was done, pulling apart the mortise. Sinclair's net was described in the treatment of compound septic fracture of the pelvis and hip joint.

AT THE CHILDREN'S HOSPITAL, NOVEMBER 22, 1919

Dr. Cushing talked about the sequalae of meningitis. He explained that it is endemic in Montreal. In 1917 there was an epidemic, and there have been sporadic cases ever since. Differential diagnosis must be made from acute pneumonia, arthritis, tuberculosis, and meningitis. The most successful treatment is by lumbar puncture, and serum, but it is necessary to get polyvalent serum. The sequalae are deafness, blindness, and arthritis, which is one of the most common. At first the disease is a septicemia. One of the dangerous sequalae is non-suppurative, internal hydrocephalus. There is no treatment of any avail, although he showed one boy in which one puncture with emptying of the ventricles of the brain gave complete and permanent relief.

Dr. Forbes showed cases in which he had stabilized knees in infantile flail legs. His method is to do an erasion of the cartilage with a saw. He puts the knee up in slight flexion. There should be a slight bowleg to counteract the tendency to knock-knee in these cases. He uses a nail or couple of nails to maintain the position according to the method of Stiles.

OCCUPATIONAL THERAPY AT MILWAUKEE

(From a Recent Report)

The Curative Workshop and Occupational Therapy Department at Columbia Hospital was made possible by the Junior League of Milwaukee and was opened May 5th, 1919. The Hospital provided the building and pays for heating, lighting, and so forth. The Junior League equipped the shop and is paying running expenses, and the salary of the Director, and providing volunteer assistance from time to time.

This department is under the direct supervision of the medical staff. The doctors prescribe the work for the patients. At first they are only permitted light occupations which can be brought to the bedside. When ambulatory they are able to work in the sun parlors, and later to go to the shop, where heavier work can be undertaken. After being dismissed, the patients can still keep up their treatment, as the Junior League provides automobiles to carry the patients back and forth to the shop.

The Director is assisted by nurses who are in training at Columbia Hospital. They are required to give at least three weeks to the study of occupational therapy. In addition, students who have completed the training course in occupational Therapy at Milwaukee-Downer College are detailed to hospital occupational therapy under the Director at Columbia Hospital.

The Junior League has equipped the Department with the Mackenzie Reconstruction Apparatus for re-educating muscles and joints that have been stiffened through operation or sickness. This apparatus includes the following:

1 Finger stretcher.

1 Bench and arm table with a creeping board, treadmill with weights, finger machines, wrist circumductor, wrist adductor, wrist roll and supinator.

Ankle Circumductor, foot drop machine with weights, foot evertor, knee and hip rotator, parallel bars and ladder with eversion and inversion treads.

1 Protractor.

The shop has looms and Velocipede scroll saws for exercising the knees and ankles, and the handles of tools are adjusted to fit

the deformity of the patient's hands. Mr. A., for instance, had an injured wrist which left the hand paralyzed. He spent 45 hours in the shop making a tabor of hard oak, on which it was necessary for him to use a scraper that gave his wrist the desired movement.

Mr. B. loosened a stiff knee by operating a foot power scroll saw for 97 hours.

Mr. C. had a crippled shoulder which he was convinced could not be used. Basketry and toy making proved to him that he could use his shoulder. After 74 hours in the shop he returned to work.

Mr. D., paralyzed from poliomyelitis, improved the use of his muscles by the use of the drill-plane and scroll saw so that he was able to return to his work.

Miss E. was a case of melancholia. After finding a new interest in weaving and basketry she was able to regain a more optimistic point of view and find work.

Mr. F., a boy of 17 years, compelled to wear a cast from his waist down for six months, is being brought to the shop so that he may be as active as possible and the atmosphere of work may be kept before him.

The shop is a delight to the children who have to stay in the Hospital for long periods of treatment. They spend many hours in the shop making toys, playing the Victrola, painting baskets and other articles for patients confined to their rooms.

The shop is equipped to provide wood work, weaving, basketry, toy making, book binding and many light crafts for the bedside patients.

Number of patients treated between May 5th, 1919, and February 1st, 1920:

Aggregate number of hospital patients, May, 31; June, 63; July, 93; August, 93; September, 76; October, 148; November, 119; December, 157; January, 91.

Aggregate number of out patients, May, 12; June, 16; July, 36; August, 21; September, 20; October, 20; November, 26; December, 23; January, 28.

Number of hours spent by out patients in shop, June, 89; July, 173; August, 101; September, 152; October, 200; November, 186; December, 185; January, 247.

Teaching Force: Director, Hilda B. Goodman; assistant, Elsa Dudenhaefer, at Children's Hospital.

Student Nurses since September: 12.

Students from Milwaukee-Downer College: 7.

Financial Statement: Cost of installation, operating, etc., to February 1st., $3,000.00.

The work was extended to the Milwaukee Children's Hospital November 1st, 1919.

Number of patients: November, 49; December, 51; January, 56.

Teaching Force: Director, Hilda B. Goodman; assistant, Elsa Dudenhaefer; aides, Alice Ogden, Dorothy Brown.

Editorial

Directly and indirectly the editor of this Journal has had a good many inquiries in regard to the brace making side of the work of the orthopedic surgeon. Except for those surgeons who are in the largest cities the securing of well made, perfectly fitting, efficient apparatus presents great difficulties. More than this, to secure apparatus at the exact time when needed, unless the brace shop is within a few city squares, is usually impossible.

In all the military orthopedic and reconstruction establishments a brace and splint shop, however incomplete, was always to be found. The necessity of this shop was always recognized and usually met fairly well. At some of the hospitals in France the braces and splints made were hastily constructed from odds and ends of material. As a rule, however, these braces and splints were usually ready when wanted, fitted fairly well, and were quite efficient.

Many of the men who were required to produce splints and braces in these shops have profited by the experience and are themselves establishing or encouraging the establishment of such shops as adjuncts to their hospitals or offices here at home.

For the assistance of such men the editor has asked for and received the following information from the splint shop in the University of Iowa. Dr. Steindler has succeeded in developing not only an excellent clinic in this new hospital but a well equipped and extremely productive shop. In regard to the shop he reports as follows:

"Up to August, 1919, the shop was only inadequately equipped and our yearly output was only about three hundred (300) orders, which included braces as well as Orthopedic shoe work.

Machine Room, Old Equipment: 1 Throatless Shears, 1 Small Gas Forge, 1 Drilling Machine, 1 Coal Forge, 1 Set Polishing Heads.

In August the following equipment was bought: 1 Power Shears, 1 30-lb. Power Hammer, 1 Brazing Outfit, 1 Rockford Milling Machine, 1 6-in. South Bend Lathe.

All these machines are run by 1½ horse power motor.

Leather Room, Old Equipment: 1 Singer Leather Sewing Machine, 1 Dandy Jack.

Additional equipment bought in August: 1 Duhrkop Sewing Machine.

We also got all necessary tools for steel and leather work.

The additional equipment amounted to an outlay of between nine hundred and one thousand dollars ($900 to $1,000). The value of the total equipment being not over eighteen hundred to two thousand ($1,800 to $2,000).

In addition to the one experienced leather worker, and shoe worker, we have an experienced machinist. For the leather and finishing work we also have two women helpers.

The output in the fiscal year 1918-1919 amounted to a total of three hundred and five (305) orders, braces and Orthopedic shoe work. This did not include repair work.

I am able to give the output on the basis of the last four months as follows: The yearly output would be not less than between 900 and 1,000 braces. About 10% of these are body braces, 40% braces for the lower extremities, 14% braces and splints for the upper extremities, 36% Orthopedic shoe work.

The cost price for these braces range between one to five dollars ($1 to $5) for splints, thirteen to eighteen dollars ($13 to $18) for leg braces, twenty-two to thirty-eight dollars ($22 to $38) for standard body braces.

This includes the cost of construction, wages, losses and depreciation.

With the present working force of four people the output capacity will probably be increased this year to 1,200 orders.

We contemplate the addition to this equipment a nickel plating outfit. This will increase the durability of the braces and save time by lessening the demands for repair.

The above list does not include any repair work."

A. Steindler.

The supervision of such an establishment as this or a smaller one adds greatly to the responsibilities of a busy surgeon. Once the shop is in successful operation, however, it will be found that the much better service that can be given to patients and the greater satisfaction to the surgeon resulting therefrom are very great compensations. In even a small shop it is possible to turn out one or two splints or braces a day, usually within twenty-four to forty-eight hours of the time the measurements are taken. Also, necessary alterations and readjustments can be made in the same shop at any time and with more satisfaction.

SOCIAL SERVICE FOR CRIPPLES AT CARDIFF, WALES

During the time the writer was on duty with the British in South Wales, he was much impressed with what a certain kind of social service was doing for the crippled, in and about Cardiff. Influenced by Sir Robert Jones, and under the immediate direction of Col. Sir John Lynn Thomas, the war wounded in the Welsh Orthopedic Center, and in the Prince of Wales (amputation) hospital, were receiving excellent attention.

For civilian cripples a few beds were provided and Dispensary service was given at the King Edward VII Hospital with Mr. Geary

Grant in charge, and Mr. J. O. D. Wade as one of the consulting surgeons.

Even so, at first glance it seemed that very little was being done for the cripples of so large a civilian population. Later one learned that there was a society known as The Cripples Society. Dr. Hoyle, of the Welsh Museum is chairman of the committee and Mr. Hodges has looked after the detail work of locating patients and arranging some kind of care for them. The following abstract of a recent report to the committee shows how helpful such work can be in the absence of a special institution for the care of this class of patients:

"1919"

Some 170 cases have been seen during the past year. Sixty of these are old cases now cured and earning their living in various ways, or they are former cases of the Cripples Aid Society, now under Dr. Gilchrist (Tuberculosis officer). Fourteen are new cases —six of these have been or are at the present time in hospitals, four have had irons and boots.

The remaining ninety odd, are in touch with the Society for various reasons, such as requiring new high-boots, irons, or spinal jackets at intervals. Some are awaiting beds at the London Hospitals or having recently returned home need visiting to see that they are progressing satisfactorily, wearing their irons, etc.

Ten cases are receiving or have received treatment at the London Orthopaedic Hospital during 1919, and three have been at the Bristol Royal Hospital. Nine cases have been for day expeditions to London, to be fitted with new boots and irons; this means going up twice, once to be measured and once to be fitted.

Six cases have had boots made in Cardiff. Four cases have had a much needed change at the "Rests," and a spinal case had a month at Weston. Two cases have received much benefit from massage, extending over some two months. One small boy of four, being unable to walk at all, even in his irons, at the commencement of treatment, was able at the end to walk about quite freely, across roads, etc.

Various bathchairs are lent out and some of these have required new tyres and so forth. The Society is also supporting Winnie Glidland, a very bad case of Infantile Paralysis, who is

being educated at Halliwell, Wischmore Hill, and two boys are being trained to a trade at Wrights Lane, Kensington. Another case is Doris Davies, age 6, one of six children under fourteen, who is at the Cheyne Hospital at the Society's expense. Her mother has been in an asylum for a year and there was no one to look after the child at home."

That Cardiff will eventually have a special hospital for crippled children is very likely but in the meantime, The Cripples Society deserves great credit for what has been and is being accomplished.

Correspondence

ANNOUNCEMENT 1920 ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION.

To the Editor of the Journal of Orthopaedic Surgery:

It is felt by the President that the following information will be of interest to the members of the Association:

The next meeting of the Association will be held in Toronto, Canada, on June 7, 8, 9 and 10, 1920. Monday, the 7th of June, will be a Clinical day and preparations are well under way to make this a most enjoyable and profitable day. It is hoped as many members and guests as possible may plan to be present to take advantage of the opportunities of seeing the work of the Canadian hospitals, both military and civilian. The three following days will be occupied with the regular program of the Association, and the Program Committee is already at work and a most attractive program is planned.

We had hoped to have the British Association meeting with us in joint session, but on account of war conditions the Secretary of the British Association states it will be impossible to accept our invitation.

We have, however, individual acceptances of our invitation by a number of continental surgeons, and we are delighted to be able to state that Sir Robert Jones will be present, together with a number of other men from the British Isles who have rendered distinguished service during the war. Among these are Major Naughton Dunn of Birmingham, Major T. H. Armour of Liverpool, Major Rowley Bristow of London, and others. Professor Jacques Calvé, of Berck Plage, France, has also promised to be present and contribute to our program.

Professor Putti, of the Rizzoli Institute, Bologna, Italy, has also consented to visit us and will make an interesting contribution.

Toronto is a noted convention city and should be at her best in June.

Will not all the members make a personal effort to be present that the Association may go "over the top" in an effort to reach our objective, namely, the greatest meeting in the history of the Association.

CLARENCE L. STARR, *President*.

To the Editor of the Journal of Orthopaedic Surgery:

Having read with much interest the article on tuberculin by Dr. Kleinberg, published in your issue for December, and also the remarks of Dr. Landman and Dr. Leo Mayer in the January number, we should like to add our experience, having used tuberculin in treatment in over 200 cases.

We had our early training under Dr. Ellis Bonime at the Polyclinic Hospital in 1915. After carefully studying the method of treatment for six weeks, we decided to place some thirty cases of bone and joint tuberculosis which we had under our care at the time on tuberculin.

So as to test out tuberculin therapy thoroughly at the outset of our study, we placed all our available cases under the treatment. There was no selection of cases, the mild as well as the severe ones were put on it alike, and among them there were some very remarkable cures.

John P., age 7; had severe tuberculosis of one tarsus and one hip. He had been in the hospital 14 months and in spite of the best orthopedic treatment he was steadily getting worse. At the time tuberculin was added to his treatment the two affected joints had been discharging pus profusely for many months, and the astragalus had been spontaneously thrown off; apparently he was a hopeless case. Four months after tuberculin was added to his treatment he was up out of bed, and in the course of two years he was pronounced cured in August, 1917, and has remained well ever since.

Joe P., aged 9; had been in the hospital four years with hip and ankle tuberculosis, both joints were suppurating profusely. Notwithstanding all our orthopaedic treatment he did not improve, but seemed to be slowly failing. When tuberculin was added to his treatment he began to improve rapidly, and in four months' time was allowed to be up on crutches. The sinuses, of which he had several, were treated with bismuth paste and autogenous vaccines. He was discharged cured, February, 1918, two and one-half years from the time tuberculin was started, and has remained well since.

James S., aged 2¾; was first seen at the hospital October, 1911, and a diagnosis of Pott's disease with slight deformity was made. He was treated with plaster of Paris jackets and did as well as the average case does under that treatment. In February, 1913, the advantages of a spinal graft operation were explained to the child's mother, and with her consent the Albee operation was performed. The wound healed by primary union and in four months' time the boy was discharged from the hospital simply wearing a Taylor back brace for protection. In December, 1915, he returned to the clinic and a diagnosis of acute pulmonary tuberculosis was made. With the aid of our social visitor, he was fixed up at home in bed with the windows open and merely brought to the clinic twice a week for tuberculin treatment. He improved rapidly, making an uninterrupted recovery in the course of 18 months, and has remained well, needing no treatment since May, 1917.

V. S. was a lad of 10 years of age, of well-to-do parents, able to give the boy the best of care and living in a country town much frequented by New York business men. When first seen he had tuberculosis of one wrist joint with a good sized abscess and also tuberculosis of one knee. The abscess was opened and much creamy pus was evacuated. Both joints were put in plaster of Paris and the patient allowed to walk on crutches. The wrist joint responded to treatment and recovered with good motion in the course of two years. The knee, however, did not do well and in two and one-half years from his first visit his hip joint lighted up. From that time on he became worse, having night cries and all the symptoms of acute hip disease. The boy was given

every advantage. An upper outside porch was built and a special nurse obtained. He was given the most careful orthopaedic treatment. Notwithstanding all that was done for him, he steadily became worse. Both his knee and hip joints suppurated and finally when he seemed to be in a hopeless condition, as a last resort, tuberculin was added to his treatment. After two weeks of tuberculin therapy his parents noticed an improvement which steadily continued until recovery took place in about two years' time.

After two years of extensive use of tuberculin, we published* our results, from which the following summary is taken:

"Table 1. Summarizes the results in the treatment of fifty cases in the Home for Crippled Children without tuberculin, and Table 11 shows the results of treatment in an equal number of cases treated with tuberculin in the Home for Crippled Children, in the Mountainside Hospital Clinic and in private practice.

We will give the conclusions which have been drawn from these tables and refer to some special cases by number.

Without tuberculin 16 recovered, or 32 per cent; 25 died, or 50 per cent; 9 are still wearing braces and under treatment, or 18 per cent.

With tuberculin 33 recovered, or 66 per cent; 5 much improved, or 10 per cent; 6 died, or 12 per cent; 5 still under treatment, or 10 per cent; 1 discontinued tretament, or 2 per cent.

Of the cases treated without tuberculin the total period under treatment for the entire number was 235 years and 9 days; the average length of the treatment for each patient was 4 7/10 years.

Of those treated with tubèrculin the total time of treatment for all the patients was 54 years, 11 months and 9 days, an average for each patient of 1 year and 1 month.

Of the 16 cured without tuberculin the average period of treatment for each case was 5¼ years.

Of the 33 cures with tuberculin the average period of treatment for each case was 11½ months.

Of the 25 deaths without tuberculin the whole period of treatment was 72 years, 11 months, 9 days, or 3 years, 14 days for each patient.

Of the six deaths of those treated with tuberculin the total period of treatment was 4 years, 9 months and 29 days, or an average of 9 months, 13 days for each patient.

Of those treated without tuberculin, nine are still under treatment.

Of those treated with tuberculin, five are still under treatment."

Before the advent of tuberculin in our practice, we considered that the time necessary to cure tuberculosis of a joint was from three years to an indefinite number of years. Since we have used tuberculin we consider the average length of time to produce a cure to be from one to two years. By this we do not mean to say that every case is cured in two years or less, but we do mean to infer that by the careful use of tuberculin in conjunction with

proper orthopaedic care the time required to produce a cure is cut down from 50 per cent to 75 per cent and the cures are much more permanent.

When tuberculin therapy was instituted at the Home for Crippled Children we had a number of chronic cases which we had been treating for years and the ward dressings were a round of pus cases. A few months of tuberculin therapy with the use of suitable vaccines and bismuth paste were sufficient to clean up the pus cases to such a surprising extent that only a case here and there was discharging any pus to speak of.

In using bismuth paste, care was taken not to inject it into blind pockets and if these were found by the X-ray suitable counter openings were made so that all the sinuses could be flushed from beginning to end. It might also be mentioned that tuberculin was not used exclusively, but where there was any suspicion that a child had a syphilitic taint, regardless of a negative Wasserman, mixed treatment was used at intervals or alternating with tuberculin.

We consider that the use of tuberculin is absolutely essential for the rapid cure of bone and joint tuberculosis, but no set rules can be laid down for its administration in all cases. Each physician who attempts to use tuberculin should be carefully and properly instructed in its use and in its abuse. Set rules for teaching purposes and as guide posts for beginners are of the utmost importance, but after the student of tuberculin therapy has mastered the rudiments of the science and as he goes on carefully studying his cases, it gradually dawns upon him that his set rules, which were so valuable in his early days of instruction, must gradually be discarded and after all the patient, and not the disease, must be treated.

A tuberculin reaction is never justifiable. We do not wish to infer that we never get a reaction, but if we do we at once reduce the dose to one-tenth the amount so as to insure prevention of another one.

The great fault of tuberculin therapy lies in the administration of it in too large and too often repeated doses. A good rule to follow is, the more the patient needs tuberculin the smaller the dose should be. We have almost entirely given up the lower dilutions of tuberculin, such as one in ten and one in one hundred. The dilutions we most frequently use are 1 in 100,000, and 1 in 10,000. Usually no heavier doses are needed, although patients may need several short interrupted courses.

Sincerely,

SIDNEY A. TWINCH, M. D., F. A. C. S.
ALFRED STAHL, M. D.

24 Fulton St., Newark, N. J.

Personal

Dr. Charles Dwight Napier has returned to civil practice after an extensive military service. Dr. Napier is at 100 Lafayette Avenue, Brooklyn, New York.

Dr. John V. Hartman, who was with Base Hospital No. 9 at Chateauroux and later consultant in Orthopedic Surgery at Kerhuon, Brest, has returned to private practice. He is at 131 West Sandusky St., Findlay, Ohio.

Dr. Henry Keller has relocated at 143 W. 86th St., New York City.

Dr. Herman C. Schumm, who was Evacuation Medical officer for the Nantes Hospital Center during the active period following the armistice, is now located at 141 Wisconsin St., Milwaukee, Wisconsin.

Dr. Thomas Madden Foley has relocated in civil practice and is at 1334 Nineteenth St., Washington, D. C.

Dr. Walter I. Baldwin, who was on military duty with the British at Edinburgh for almost two years, has returned to civil practice. He is at 800 Powell St., San Francisco.

Dr. W. K. West has located at 508 S. W. National Bank Building, Oklahoma City. Dr. West has been making a study trip in orthopedic surgery by way of preparing for association with the orthopedic department in the Medical School of the University of Oklahoma. Dr. West has spent some time recently with Dr. Porter in Chicago, and has visited also the clinics of Dr. Gaenslen of Milwaukee, Dr. Steindler of Iowa City, and at Omaha, Lincoln, and St. Louis.

Dr. W. E. Meredith, who was in charge of the surgical service at Camp Dodge, Iowa, and Dr. R. T. Miller, who was Chief of Surgical Service, Base Hospital No. 27, Angers, have returned to practice in Pittsburg and have both resumed their duties in the University of Pittsburg.

Dr. J. P. Lord, Dr. R. D. Schrock and Dr. W. E. Wolcott, have joined in a co-partnership for the exclusive practice of Orthopaedic, Bone and Deformity Surgery, 830 City National Bank Bldg., Omaha. Miss Helen King, formerly of Boston, is in charge of the Physiotherapy Department.

In the distribution of funds by the United Hospital fund of New York City, the New York Orthopedic Hospital has recently received about $21,500, the hospital for Ruptured and Crippled over $15,000 and the hospital for Deformities and Joint Diseases about $4,000. This distribution is made on the basis of free treatment provided by the different hospitals during the past year. The number of free patients treated, and the cost per day, determines the amounts to be given to those New York hospitals which receive part of their support from this fund.

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PREPARED BY DR. J. E. M. THOMSON, LINCOLN, NEBR.

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Current Orthopaedic Literature

A CONSIDERATION OF SOME OF THE PROBLEMS PRESENTED BY AMPUTATIONS. By Clarence L. Starr, M. D., Toronto, Lieut.-Col., C. A. M. C., Ottawa, Ont. *The Journal of the American Medical Association*, Vol. 73, No. 21, November 22, 1919.

An ideal stump should have a linear scar free from puckering or infolding of the skin, with sufficient flap to cover the end of the bone, but without redundancy. It should have a pad of fat and subcutaneous tissue over the bone end, and should not be adherent. The joints above the amputation should have a full range of motion.

SURGICAL PROBLEMS

1. All tissues harbor latent infection, which may be lighted up very easily. In some instances, massage and manipulation of the stump may be sufficient to produce a cellulitis which may become very troublesome. Rest, and in some cases incision is required to drain local collections of pus.

2. Ulcers remain in some cases after old, so-called guillotine operations, or may result from breaking down of scar. These ulcers and scar tissue should be excised and a linear scar substituted. This is often possible without sacrificing any length of bone, if adhesive strips are attached to skin above the ulcerated area, and extension made by means of weight and pulley, or by means of modified Thomas knee splint. It is very good practice to attempt skin grafting in these ulcerated areas.

3. A sinus or a series of sinuses may combine, and are sometimes very difficult to get permanently healed. These sinuses persist as a result of either a foreign body at the bottom, or owing to the fact that they have developed a rigid, noncollapsible wall of fibrous tissue, and on removal of the cause they will invariably heal promptly.

4. Spurs of bone or exostoses are of frequent occurrence, and various explanations are given for their presence. The most common explanation given and accepted is that they are due to a tearing up and partial detachment of shreds of periosteum, from which new bone is developed in all sorts of irregular shapes. The theory is offered that they are due to small bone fragments broken off by the saw, or by snapping the last small bit before the saw cut is complete, or by the sawdust itself.

5. Nerve buds or fibroneuromas are not infrequently found. The oblique cutting of the nerve, the fish-tail section, the stripping back of the sheath, cutting the nerve at a higher level, and then tying the sheath over the cut ends —all these methods are advanced; with the greatest amount of success probably following the last named method.

NON-OPERATIVE PROBLEMS.

1. Edema persists in most stumps for some weeks after all wounds are healed. No permanent appliance should be applied until this has subsided, and

the atrophy of unused muscle tissue has taken place. The disappearance is hastened by suitable pressure bandage together with massage of stump. It is more efficiently treated by additional use of a temporary peg with plaster or leather bucket. Deformity is nearly always present in a greater or lesser degree in the joint above the amputation. This is due to contraction of the muscles controlling the joint, to long continued flexion position, to adhesions of opposing muscles to one another and to the bone, to infection or infiltration with blood, or it may be due to adhesion from infection or blood in the joint itself.

2. Loss of muscle power as a result of disease exists in all amputation stumps and a considerable training is necessary before the stump is in a good condition to swing an artificial appliance and make good use of it. For the purpose of improving muscle tone regular classes are formed in the gymnasium and workshops.

A CONSIDERATION OF THE VARIOUS TYPES OF AMPUTATIONS

In the lower extremity, an amputation of the toes, provided the plantar is brought on top, is almost no disability. One toe should never be left as it soon becomes distorted, and adds no element of usefulness. The tarsometatarsal amputation can be made very satisfactory if the peronei are left intact on the outside, and the tibials on the inside. The midtarsal amputation results in an unbalanced foot with elevation of the heel and downward pointing of the foot.

The Syme amputation is theoretically and practically the best in the lower extremity and yet it is surprising how many of these are faulty. The chief defect is too long a flap or too much bone removed from the end of the tibia and fibula, resulting in a bearing end which is not stable, and which rolls forward or to one side.

In the leg an amputation should not be done within a hand-breadth of the ankle, in order to give ample room for an ankle joint properly placed in an artificial leg. Above this point the longer a stump can be made, the better leverage is given and the easier the man will walk, and the less limp is developed.

In the thigh as in the leg, the longer the lever the better the artificial limb may be used. The Gritti-Stokes is the best of the thigh amputations and is to be selected in preference to the knee-bearing. This gives a very good end-bearing stump when the operation has been well done.

A stump under 5 inches in length from the perineum can scarcely ever be fitted with an artificial leg without a pelvic band, and all such should be so fitted. Amputations at the level of the trochanter minor or above, including disarticulation at the hip, have insufficient leverage to use a thigh bucket, and a pelvic cradle, the so-called "tilting table" of the English manufacturers, must be adopted, with automatic lock joints both at hip and knee.

The end-bearing stump is of great assistance in permitting the easy locomotion of the wearer of an artificial limb, but aside from the two types, a Syme in the leg and a Gritti Stokes in the thigh, a complete end-bearing stump is never possible. It is possible both in the leg and in the thigh to get a partial end-bearing stump in a good many cases, properly supplied with a good pad

over the end of the bone. This partial end-bearing stump is best accomplished by means of the hammock suspended in the bucket, by means of which the wearer may graduate his weight bearing.

Any of the digits which can be saved in a useful position may be found of great assistance as an opposing factor to a mechanical appliance. Fingers whose tendons, both flexors and extensors are hopelessly tied up and the joints of which are destroyed by the overgrowth of the fibrous capsule, may be advantageously sacrificed to make way for a hook or some similar device. At the wrist, the whole carpus is rather a detriment than a benefit and should not be saved, especially when the carpal joints are fixed. The artificial appliance supplied to such a hand will be long and cumbersome and not easily manipulated.

When possible, the radio-ulnar articulation at the wrist should be maintained, as it permits of the most useful movements of pronation and supination. In the forearm, the length of the stump is the chief factor in determining the usefulness of the arm, as each inch of stump adds materially to the leverage, and to the power of such an arm. A stump of 1½ inches or less below the fold of the elbow is useless as it pulls out of the bucket in attempts at flexion. When movement alone is of value, even if no power can be developed, a leather cap over the short stump with a compound lever may be utilized successfully.

The policy has been to furnish a permanent peg and an artificial limb to each man who has an amputation of the lower extremity, and a working arm and a so-called dress arm to those who have an amputation in the upper extremity. The attempt to combine the two arms in one has not been satisfactory.

The Peg Leg.

The peg leg is a temporary appliance based on the Thomas knee splint. It has a shaped ring at the top, taking the top of the bucket of the artificial leg as a pattern. This takes the bulk of weight on the tuberosity of the ischium, and eliminates the troublesome pressure on the perinium. The ring is well padded and leather covered. A little behind the center of the ring, two steel bars drop to a point well below the stump, where they unite in a ferrule, into which is fitted a wooden peg ending in a wide rubber walking pad. A leather bucket is attached to the posterior half of the ring only, and by a loop around each side bar. The lacing is made smaller than the circumference of the thigh, so as to permit snug fitting, for the purpose of shrinking the stump. A hammock is slung in the lower part of the bucket to permit of padding to encourage the weight bearing, or short of that to keep up even pressure on the stump to prevent local edema. This whole splint is suspended from the opposite or both shoulders by the usual webbing braces. The peg without joint at the knee for above-knee amputations has been selected because it has been established that they get about more securely, and walk better and with more confidence than they do with either a peg with flexible knee-joint, or with a temporary leg of the usual pattern. All pegs should be at least three-fourths inch shorter than the corresponding leg.

Wood was selected for the bucket of the standard limb because it is worn the most comfortably of any of the materials used. It does not sweat and

macerate the skin, it is lighter than leather, and once having been fitted accurately, does not change its shape. This is especially true of the below-the-knee type.

ARTIFICIAL ARMS.

After thorough trial it has been found that the very complex mechanical arms are not satisfactory, and they have been eliminated. They are found heavy, with the greatest weight at the point farthest from the body, namely, in the hand. They are for the most part metal, and in our western country are claimed to be very cold.

After all one's ingenuity is exhausted, and every device has been tried, it is still found that it is difficult to fit some men with apparatus with which they can "carry on" in civil life, unless one can instil into them that element that seems to be lacking, namely personality or character. It is impossible to prevent others who have this character in large measure from doing anything that "any white man can do" as one of them expressed it, even if their appliances are crude or home-made.

For this reason every effort is made by encouragement, by example, by contact with others similarly afflicted who are able to accomplish useful tasks, and by training and enthusiastic support of the medical officers to improve the morale of this type of afflicted patient.—*Leo C. Donnelly, Detroit.*

TREATMENT OF CAUSALGIA. RESULTS OF INTRANEURAL INJECTION OF 60% ALCOHOL. By Dean Lewis, M. D., Chicago and Wesley Gatewood, M. D., Iowa City. *The Journal of the A. M. A.*, Vol. 74, No. 1, January 3, 1920.

Causalgia has as its prominent feature pain which is described as burning or throbbing in character and is often compared to the sensations produced by pin pricks, a red hot iron or an injury of the flesh. This pain, which never ceases, even at night, may be aggravated by any number of causes and finally become paroxysmal.

Weir Mitchell believed the pain due to an ascending neuritis which might involve any injured nerve and gradually involve all the nerves of the extremity affected. It seems to have been demonstrated as a result of surgical interference, that the median nerve is involved most frequently in causalgia affecting the upper extremity, and the internal popliteal in causalgia involving the lower extremity.

The pathology differs widely in different cases. Joyce has reported five cases, in one of which the median nerve when freed from scar tissue appeared swollen and bluish gray, mottled with purple spots. A small neuroma, which was adherent to the biceps, was found on the nerve. In another patient who complained of severe pain in the foot when walking, sitting or lying down, but who had no paralysis or anesthesia, there was found on roentgenographic examination a small foreign body in the neighborhood of the sciatic nerve. When the operation was performed the foreign body was found imbedded in scar tissue just posterior to the nerve. Immediate and permanent relief of pain fol-

lowed removal of foreign body. Gosset found the median nerve only slightly affected in the operations performed by him to relieve causalgia affecting the hand. In one of the cases observed, the median and ulnar nerves were definitely enlarged and indurated just above the antecubital fossa; in another, the internal popliteal nerve was surrounded by some adhesions which were not dense and the long saphenous nerve, which was subsequently injected below the wound appeared normal. In both of these cases, neurolysis had been previously performed, but had given no relief. In the third case, the median nerve appeared injected and some what enlarged, but its consistency did not differ from that of a normal nerve.

Sixty per cent alcohol seems in some cases to interrupt the conduction of sensory impulses, but not to interfere with the transmission of motor impulses.

When this injection is made, the nerves affected should be exposed under general anesthesia. The injection should be made above the wound or site of the injury, for in those cases in which the injection has been made below, the results have been temporary. From 1 to 2 c.c. of 60% alcohol should be injected. As this is injected the nerve swells and becomes white, resembling in color a nerve that has been fixed in alcohol for histologic study.

Whenever neurolysis is performed in cases of causalgia it should be combined with an intraneural injection of 60% alcohol. Neurolysis alone, does not control the pain in many cases, and in those in which there is some relief, it is but temporary.—*Leo C. Donnelly, Detroit.*

BONE GRAFTS. W. I. de C. Wheeler. *Dublin Journal Medical Science*, July, 1919.

Wheeler points out, in the discussion of the function of the periosteum, that in operations on children the bone-producing layer is raised with the fibrous layer and the membrane is capable of producing new bone with mathematical accuracy. In adults, on the other hand, subperiosteal resection may or may not be followed by new bone formation, according to whether or not the osteoblasts are detached from the bone while the periosteum is being separated. From a practical point of view, absence of periosteum from an implanted graft means slower vascularization and longer convalescence for the patient. The bone graft is not merely a scaffold, but is really living and carries its own osteogenetic power. This is shown by the formation of callus in a fractured graft. Accidental infection of the field of operation only leads to failure of the graft when the infection is in a streptococcal or other severe form. It is not true that bare bone is of necessity devitalized and will end in sequestration in infected fractures. The same observation applies to a bone graft. It is, therefore, inadvisable to remove loose fragments in the early treatment of septic fractures, or to disturb a bone graft in the presence of accidental infection. The first considerations in bone grafting are how to fix the graft and the method of immobilization. The slightest movement in a grafted bone may lead to failure. In old ununited fractures, where radical shortening is inadvisable, a graft which extends well beyond the sclerosed ends will have the best chance of success. A sliding graft has to depend on defective bone, and is therefore unreliable.

When shortening is done, the "step" method should be used. The intramedullary peg yielded excellent results in the author's hands, but there is a danger of fracture during convalescence. In the bones of the forearm intramedullary grafting is favoured, but for the larger bones the more stable lateral inlay grafts are preferred. When the inlay graft is used, the upper end is laid in a groove and in addition is pushed into the intramedullary cavity for a short distance; the lower end is fixed in a prepared groove by passing catgut sutures around the graft. Rigid fixation by mechanical means prolongs the time of operation and adds the risk of complications. In all the author's cases except two the graft consisting of periosteum, compact bone, endosteum and marrow, was taken from the tibia by means of Albee's twin electromotor saw. The risk of fracture following the removal of grafts from the tibia can be minimized by avoiding the crest of the tibia and by advising the patient to wear a plaster casing for some months. Deformities should be corrected before grafting is attempted. Fixation is advisable for about three months after the operation, but it is to be remembered that reasonable function is the only way of encouraging complete restoration of the defective area.—*J. E. M. Thomson, Lincoln.*

Treatment of Wide Resections of the Shoulder. Dionis du Sejour. *Revue de Chirurgie*, March-April, 1919, No. 229.

The deplorable functional results following extensive resections of the shoulder, so frequent in the war, seem to have urged the author to a special study of the subject. The ideal treatment of a flail shoulder (quoting Mauclaire) is to graft a bony humeral head onto the remaining shaft. Practice, however, does not as yet come up to such a high ideal. Conservative treatment by means of prosthetic apparatus is satisfactory in some cases, but cumbersome forms of apparatus which encircle the thorax, elbow and neck as well as the shoulder are to be avoided because of the tendency to impair muscular action. Numerous schemes for utilizing the remaining muscle have been devised by various surgeons. Chutro sutures the trapzeius of the fascia of the deltoid. Walther has sutured the remaining fibers of the deltoid to the clavicle, the scapula having been destroyed. Many have tried suspension of the humeral shaft to the acromion by wire. The interposition of an ivory head for the humerus has been tried with incomplete success.

Placing the upper extremity of the shaft in the glenoid (which is the method studied in this paper) was practiced as early as 1860 by Chenu, without, however, keeping the arm fixed in abduction. It is of small importance whether this upper end be large or small, concave or convex, irregular or smooth. The author's observations comprise 37 cases, 15 of which he had resected himself and 22 which came for treatment after resection elsewhere. In the first group the reposition of the humeral shaft into the glenoid was done four or five days after the primary resection. The shaft is held in place in the glenoid by an apparatus made of plaster and small iron rods which holds the arm in extreme abduction and allows access to the wound. Fixation of the end of the shaft by bronze wire through the acromion was tried and abandoned because of re-

sulting infection and necrosis of the bone. The immobilization is kept up for about two months. Patients thus treated recover with the greater part of function in the shoulder, the movements of abduction and adduction being due largely to leverage of the scapular muscles. More often the result is a pseudarthrosis, which is a good thing if the deltoid is capable of function. If the deltoid is all gone a bony ankylosis is to be sought for. In 12 of the 15 cases a minimum elevation of 45 degrees with normal function of the forearm was obtained. Three cases showed mediocre results because of failure of bony ankylosis, the deltoid in each case being already gone.

Of the 22 cases remaining, 17 have given satisfactory results, one even after a loss of 15 cm. of the humeral shaft. Three which had complete atrophy of the deltoid had poor result. Thirty-two cases are reported in detail.—*William Arthur Clark, Rochester, Minn.*

FRACTURES OF THE SEMI-LUNAR. Mauchet and Rene Pilatte. *Revue D'Orthopedie.* September, 1919.

The authors considered especially the compression fracture of the semilunar bone. These fractures are comparatively rare and are usually found in individuals from 20 to 40 years of age, seldom in infancy. According to Mourgeus among 60 cases of fracture of the wrist, the semi lunar was fractured 5 times or in 8%, while the scaphoid was fractured in 70% of the cases.

Fracture by direct violence is not known. Fractures are always caused by indirect violence mostly following a fall upon the hand in flexion and extension and sometimes following a fall upon the ends of the metacarpals. The position in which such fracture occurs is flexion and extension combined with ulnar adduction of the wrist. When the wrist is placed in abduction to the radial side the shock is transmitted to the outer side of the carpus and often causes fracture of the scaphoid, while with ulnar abduction the shock is transmitted to the ulnar side of the carpus and fracture of the semi-lunar occurs.

Clinically the following symptoms are observed: Shortening of the length of the wrist by impaction and pain, the latter might be the first symptom. It is situated immediately below the articular surfaces of the radius and is considerably increased by longitudinal pressure upon the third metacarpal.

Functional disturbance is very marked, especially if fracture of the scaphoid accompanies the semi-lunar fracture. The natural course of the disease often tends toward increasing the disability. The consolidation of the fragments is the exception. The painful symptoms persist usually. Often a traumatic arthritis of the wrist becomes established which adds to the functional disability. There is often a slight and persisting edema of the wrist. The principle features of the X-ray findings are as follows: Shortening of the wrist caused by flattening of the semi-lunar bone; this might amount to 5 to 10 mm.; changes in the contour of the bone itself, i. e., shortening in its vertical axis and flattening. The semi-lunar bone is also changed as to its location as it might be displaced to the volar or dorsal surface of the os magnum or scaphoid. The

internal structure of the bone is also changed, it appears mottled and shows vacuoles.

Immobilization is indispensible in the treatment of fractures of this kind. In cases with considerable functional disability the early removal of the bone has been done by the authors. Immobilization after resection should be carried out in slight extension. The movement of the fingers and hand should be taken up very early. The authors do not recommend the removal of the semi lunar bone but believe that one should resort to rest, hot applications and hydrotherapy.—*A. Steindler, Iowa City, Ia.*

A Revolution in Treatment of Congenital Dislocation of Hip in Young Children. By Henry W. Frauenthal, M. D., Physician and Surgeon-in Chief, Hospital for Deformities and Joint Diseases. *The Journal A. M. A.*, Vol. 74, No. 2, January 10, 1920.

Technic.

The pelvis is held fixed by an assistant, the thigh is completely flexed on the abdomen; pressure is made on the knee which brings the head of the femur under the acetabulum, and as the leg is rotated outward in the flexed position, the head of the femur is raised into the acetabulum, with the fingers of the other hand. The whole procedure is accomplished in less than a minute's time. The child is immediately placed on the ground and allowed to walk; and in one case, a child, aged 2 years, walked seven blocks on leaving the dispensary, immediately following the operation.

The method is not adapted to children that have walked on the affected limb for six months or more; then the old Lorenz method must be resorted to. It is effectual only when the child first starts to walk; and the oldest patient in whom I have been able to make the correction effectually was 2½ years of age.

Conclusions

From the observations of Thompson, Davis, and other anatomists, one may conclude that:

1. Before the child bears weight and develops muscular and ligamentous contraction, the acetabulum and head and neck of the femur are normal in a large percentage of cases.

2. With normal conditions prevailing, there is no reason why the condition should not be regarded and treated as a traumatic dislocation and replaced in the same manner, and the child permitted to go about.

When the large percentage of good results accomplished by this method are compared with those of the Lorenz method, and the great saving of time and mental suffering, this, in the future, must be the method of choice and trial, to be followed by the plaster-of-Paris fixation, if there develops a failure of retention.—*Leo C. Donnelly, Detroit.*

THE RESULTS OF RESECTIONS. Kermisson. *Revue d'Orthopedic*, September, 1919.

This paper is based on observations extending over a period of twenty years in a large orthopedic clinic in Paris. A total of 201 cases of resection were studied. Of these, 118 were of the knee, 42 hip, 19 elbow, 20 ankle and 2 of the wrist.

1. Resections of the knee.—It is impossible to speak of results in general of resections of the knee, because of the great difference in different ages of the patients. The cases are therefore grouped. Twenty-six were under 5 years of age, 22 between 5 and 10, 8 between 10 and 15, 62 over 15.

On the whole it may be said that the results in those patients under five were more or less unfavorable. Two of them still had motion and had to wear braces. Eighteen showed various vicious deformities such as flexion, hyperextension and genu varum. In six there was more or less shortening. One boy who had resection at four years had at eight years, a shortening of 13 cm., a flexion on the thigh at 135° and a little motion necessitating the wearing of a brace. By the time he was 15 the osseous consolidation was complete with the knee in almost complete extension but with a shortening of 22 cm.

Another boy who had had a resection at 3 years, showed a shortening of 10 cm. when he was 10 years old, and of 22 cm. at the age of 17. A girl of 16 showed a shortening of 21 cm. after resection at 3 years of age and a boy of 19 had a shortening of 23 cm. with flexion at 120° and marked genu varum. A man of 35 who had had his knee resected at 4 showed a shortening of 27 cm. and a flexion of about 120°.

For the group of 22 cases between 5 and 10 years old the late results were observed to be practically the same as for those under 5, that is, shortening and flexion and genu varum. A valgus position was noted in only two cases out of the 22.

As we approach the age of 15 we note that the results become a little more favorable. Of the group of cases resected when over 15, 29 out of 62 showed a solid knee in good position capable of giving excellent service. In only 3 was there any considerable shortening, 2 of which were resected at 20 years and one at 25. Five cases presented a poor position of the knee usually a varus deformity. Twenty cases had a persistent mobility, necessitating the wearing of a brace; most of them had had a prolonged suppuration. It is noted that most of these bad results were in cases where resection was done at a more advanced age, 35 to 40 years.

2. Resections of the hip.—The number observed in which resection had been done under 5 years of age was 9. In one case resected at 3, seen 10 years later there was a persistent sinus, mobility, slight adduction and 8 cm. shortening. A boy of 9 resected at 5, had an upward dislocation of the femur, 5 cm. shortening and flexion-adduction deformity. Another, resected at 18 months showed complete mobility, loss of quadriceps power, genu valgum and a shortening of 22 cm. at the age of 14. A fourth case, resected at 5, had a fairly useful hip at 16, although 10 cm. short. In the remaining 5 cases the results were satisfactory as far as position of the hip was concerned, but shortening of from 7 to 12 cm. was present in all.

In many of the resections of the group between 5 and 15 years of age there was a persistent fistula and shortening of from 6 to 18 cm. In 10 out of the 23 of this group the results were considered as satisfactory, some of them even had a little motion. The conservation of motion, although a good thing to have in the end, may be a disadvantage during the early months after resection as it predisposes to a vicious position.

Patients who had resections of the hip when over 15 do not seem to show any better results than those done before that age. There is shortening in almost all the 10 cases reported in this group and in one case an upward dislocation.

3. Resections of the elbow.—Nineteen cases are reported. Ten showed good function with freely movable arms. Nine others had movable arms with fairly good use. One patient had an anterior displacement of the humerus which prevented rotation of the forearm although flexion and extension were preserved to a certain extent.

4. Resections of the ankle.—In general it may be said that the results in the 20 cases studied were favorable. Sometimes a tendency to varus or valgus was noted but the patient was able to stand on the sole of the foot. Cases in which too much was resected or in which the operation was done at an advanced age, showed poor results usually with considerable atrophy. One woman who had had a tibio-tarsal resection at 26 had to wear a brace on account of an equino-varus deformity and a shortening of 8 cm. A boy of 18 was unable to bear any weight on his foot, which was practically reduced to a stump, and could move only his great toe as a result of a very wide resection of his ankle, when 9 years old. Two others are mentioned as bad results after too wide resection, one of which showed marked atrophy and 15 cm. shortening, the other an ankylosis in marked equinus.

5. Resections of the wrist.—Only two cases are reported, both with bad results. In one the hand falls in an attitude of radial paralysis with a lateral deviation toward the ulnar side. The other resected at six months and now 38 years old, has a useless flail wrist and can use his fingers only with the aid of a splint to support the wrist.

In summary, the author states as general conclusions that (1) the results are more favorable after 15 years of age, (2) the knee often shows a vicious position after resection, (3) the state of the surrounding muscles is of prime importance in the results of a resection, (4) it is usually better to have an ankylosed hip than a movable one which has no muscular control.—*William Arthur Clark, Rochester, Minnesota.*

Bone Fistulas After War Wounds. By Pedro Chutro, Beunos Aires. *The Journal of the American Medical Association*, Vol. 73, No. 10, September 6, 1919.

The bone fistula is established as a consequence of an insufficient treatment of wounds, whether it is because one has performed an incomplete operation leaving metallic foreign bodies, fragments of clothing, or bone fragments

which are transformed later into sequestrums, or whether one has not been able thoroughly to clean the wound, or has not been able to take the necessary steps to avoid secondary infection. The anatomic lesion is simply a limited osteitis, which easily becomes chronic.

Two factors dominate all the process of the bone fistula: First, the presence of a cavity with rigid walls; second, the infection of this cavity.

It is the cavity and the infection of the cavity which dominate the process, the one being essential to the other, and the removal of only one of these factors is not sufficient to obtain healing.

In the body, every real cavity must have a communication with the exterior, and the fistula is in reality only the exit of these bone cavities.

Bone is a specialized tissue whose evolution is terminated, and which by itself is incapable of furnishing bone to fill the cavity. It is equally incapable of giving healthy granulations; unhealthy bone only produces fungosities. These fungosities are the product of the infection of the wall of the suppurating cavity, which provokes the necrosis of little bony lamellae, around each of which grows a granulation. Sometimes these fungosities are flat and only line the wall of the bony cavity; in other cases they are exuberant and apparently fill all the cavity; but it is always easy to pass a probe between the fungosities and to feel denuded bone in the depth.

Some cases come to eliminate all the little sequestrums, and after months or years the fungosities sclerose, giving a cure of variable duration; more frequently this spontaneous cure does not take place. Bone is a tissue which defends itself poorly against infection, and once infected, it reacts in a peculiar manner, seeking to limit the process by the formation of new bone around the focus but without succeeding in cicatrizing the lesion.

Efforts have been made to establish the degree of depth of the infection of bone, and we have arrived at the conclusion that the infection is very superficial.

The bacterial flora is of the richest, and one finds all the aerobic and anaerobic organisms which inhabit these cavities communicating with the exterior.

Bone Fistula Distinguished from Osteomyelitis: This lesion is different from the ordinary osteomyelitis which commences by an infection in the metaphysis, and it follows its evolution, whether toward the periosteum through the haversian canals, or toward the marrow cavity through the spongy tissue.

Cases of bony fistula present little of the phenomena of infection because the cavity, communicating with the exterior, has little retention. Again, all the lymphatics around the focus are blocked, consequently there is no absorption of the septic products.

The treatment of bone fistula is variable, from a technical point of view, according to the bone involved, and in each bone, according to whether the lesion is located in the diaphysis or in the epiphysis.

It is necessary to place the incisions in appropriate regions even disregarding the site of the fistula, in order to avoid certain difficulties later. A straight incision on the anterolateral aspect of the tibia causes retraction of the skin which will cicatrize enormously. An incision placed on the anterior aspect of

the thigh will give rise to serious functional trouble on the part of the quadriceps; and, if the wound heals, there will remain a deeply depressed scar, ad herent to the bone, which easily ulcerates. The incision placed behind the trochanter causes difficulty in the function of the gluteus, and sometimes phenomena of compression of the sciatic. The same is true of the upper extremity.

The intervention of the bone will consist in the suppression of the bony cavity, the principal cause of the fistula. To effect the intervention, it is necessary completely to resect one of the walls of the cavity and by preference, that which is located far from important structures such as the nerves, but near muscular masses. There will remain only half of the bony cavity in the form of a simple depression, that part which was infected will be relieved of its fungosities and its sequestrums by a curettage, gentle but careful.

The cicatrization of bone is brought about by granulations, but the granulations will not come from bone; they will come from the depth toward the periphery and will grow from the neighboring muscles. These granulations will, little by little, cover the vivified surface of the bone until they cover it entirely, and from that moment the healing of the lesion is assured.

To arrive at this result, it is necessary that the vivified surface of the bone be maintained sterile during several weeks, or during the time necessary for granulation. It is here that the treatment of Carrel-Dakin finds its application. Irrigation of the wound for several weeks permits it to be maintained clean.

We do the contrary of that which others have done, instead of sterilizing the wound before interfering, the first operation is done then irrigation to maintain the result of the operation and to favor healing. If the operation has not been satisfactory, the irrigation does not augment the chances of cure.

The Esmarch bandage is not employed. The most careful hemostasis of the soft parts is secured, and irrigation is commenced immediately after the operation.

A compress left for twenty-four hours is the best medium for the reinfection of the bone which has just been cleaned. Infection of the bone takes place in a few hours.

The tibia, so accessible to the sight, has permitted us to study the different phases of the cicatrization. Certain cases in which the wounds were not irrigated until several hours after the operation presented later little bony surfaces refusing to receive the granulations coming from the muscles, and the following interpretation is arrived at: A clot having adhered to the bone, the Dakin solution maintained sterile the surface of the clot, but not the part of the bone to which the clot adhered. The fluid commences to act when the clot has been detached. That is why irrigation is commenced immediately.

When the bony surface is completely covered by granulations, one can close the wound secondarily, but this procedure does not present great advantages, rather disadvantages. The scar adheres too closely to the bone and this has no pad of protection. Irrigation is continued until complete healing is accomplished, with the aim of obtaining a cicatrix that is more supple, and especially

to have a greater quantity of connective tissues separating the skin from the bone.

When the wound is healed, the complete removal of the cutaneous scar is performed under local anaesthesia, and the most complete reconstruction possible of all the anatomic planes.

We have come to establish different types of operations which have obtained very satisfactory results. Several hundred of these fistulas have been operated upon. The first cases were failures, but in the last series of 329 cases all the wounds of the humerus have healed, also wounds of the ilium; five femurs and three tibias have not healed.

All patients, before entering Buffon, had already been operated on between four and twenty-three times, and treated with the whole series of antiseptics and pastes that were invented during the war.—*Leo. C. Donnelly, Detroit.*

TREATMENT OF GUNSHOT FRACTURES. By Jos. A. Blake, M. D., New York. *The Journal of the American Medical Association*, Vol. 73, No. 10, Sept. 6, 1919.

The limits imposed on this paper demand the briefest statement of facts and the omission of theory.

A projectile, when producing a fracture, passes through the soft parts and strikes the bone:

1. It may then be arrested but deliver enough force to break the bone. Such fractures resemble the ordinary fracture produced by direct force. In such a case, no foreign material is carried into the bone or marrow cavity, and such fractures are termed fractures by contact.

2. It may enter the bone and lodge, and produce either a hole (partial fracture) or a complete fracture with more or less shattering. Such fractures always contain foreign material. They are termed penetrating fractures.

3. It may pass through the bone and produce a hole or extensive shattering and comminution. The velocity of the projectile is imparted to the fragments, which lacerate or tear completely through the soft tissue on the opposite side of the limb. These fractures are termed perforating, and may be incomplete or complete, and may be accompanied by an extensive loss of substance. They may or may not contain foreign materials. Usually portions of the projectile remain in the wound and frequently fragments of clothing.

On account of the difference in structure, the effects of the projectile on the epiphyses and diaphyses differ greatly.

Because of the dense structure of the diaphyses and the violent vibration set up by the impact of the projectile, extensive fissuring and traumatism remote from the point of contact may occur, as evidenced by hemarthrosis of the contiguous articulations. The spongy, elastic structure of the epiphyses absorbs rather than diffuses the energy of the projectile, and the lesions are generally restricted to the epiphyses. Even in the case of small penetrating wounds, multiple or diffuse hemorrhagic areas may occur, leading to disseminated infection and necrosis.

Operation to prevent or eliminate infection is not indicated in fractures caused by rifle balls, when the wounds of entrance and exit are punctate. Operation is indicated in all fractures caused by shell or grenade fragments. In fractures caused by shrapnel balls, operation is indicated only if good technic is possible, as these wounds frequently escape infection.

In transportation of fractures, the Thomas leg and arm splints are most efficient. Every civil ambulance should be equipped with them.

1. In every fracture of a long bone, the proximal fragment tends to occupy a certain position, which is determined by the muscles attached to the fragment. The forces produced by these muscles may be termed intrinsic.

2. This position, which may be designated as the position of rest, is readily modified up to certain limits by any slight extrinsic force, that is, one operating from without.

3. Conversely, if a slight restraint is supplied, considerable motion at the proximal articulation may occur without there being any change in the absolute position occupied by the fragment.

4. Traction on the distal fragment not only prevents overriding and shortening, but when applied in the direction of the axis of the proximal fragment, when in the position of election or rest, also tends to prevent harmful angulation at the site of the fracture as a consequence of the restraining action of the sheath of the stretched muscles about the proximal fragment.

5. Proper counter balanced suspension, by allowing the limb to follow the body permits a certain latitude of movement of the latter in bed without deranging the relative position of the fragments.

6. Traction, in order to accommodate itself to the position of the patient (unless the traction is contained within the splint) must be made by a weight and cord running on a pulley; and the pulley should be as far as possible from the point at which traction is made, so as not to limit the swinging of the limb.

7. The lack of fixation in permitting a certain amount of motion between the fragments does not delay union; consolidation seems to be more rapid, probably because of better nutrition.

8. In fractures of the humerus and femur, in both of which fixation of the proximal fragment is impossible, the limb being free to follow the movements of the trunk, no violent angulating strains occur at the site of fracture.

9. With traction and suspension properly applied, it is possible to move all of the joints of the fractured limb throughout the treatment, no matter which bone is fractured.

The principles of treatment are: To avoid actual fixation; to employ traction to its fullest possibilities in overcoming deformity, and to use suspension so as to afford the greatest freedom of movement, both of the truck and of the joints. The chief and underlying principle is conservation of function.

When possible, in all fractures of the femur, skeletal traction preferably with Ransohoff's tongs is made directly on the lower fragment, and in some cases of fracture of the lower one-third, the tongs may be used to lift the distal fragment into position by elevating the axis of traction.

The Thomas is the most useful and practical for fractures of the thigh and leg, but it must be used intelligently. For some cases the half ring modification of the Hodgen splint are preferable.—*Leo C. oDnnelly, Detroit.*

OSTEITIS FIBROSA. E. G. Slesinger, M. B., F. R. C. S. *The Lancet*, No. XX of Vol. LL, 1919.

The condition known as osteitis fibrosa is now recognized to be a great deal more common than was at one time supposed.

Etiology—Many theories have been advanced to account for this condition since Virchow's original description of two cases which he regarded as the result of degeneration occuring in a chondroma. At the present time opinion is fairly evenly divided between the views that (1) it represents a metaplastic transformation of the bone marrow into a fibroid tissue, and (2) that it is the result of a chronic inflammation of unknown origin occurring in the endosteum. Whatever view is held as to the exact pathology certain predisposing factors are fairly constantly present.

Trauma has been offered as an explanation but has not been well established. Sex seems not to be a factor, but age does seem to have some bearing, a great majority occurring before the 20th year and the commonest age about the 12th year. A typical series runs as follows: 97 cases, 75 before 20th year and 22 after.

Bones Affected—A single series will be cited for brevity: 38% femur, 22% in the tibia and 16% in humerus.

Pathology—The essential pathology of osteitis fibrosa is still uncertain but the naked eye and histological picture is fairly definite in cases showing cyst formation. The cavities may be present as numerous small spaces or as one single cyst, often of considerable size. In a majority of these cases a definite cyst wall can be demonstrated with the characteristics of osteitis fibrosa. The fluid is not under much tension and is seldom haemorrhagic, but is clear, light brown in color and often of considerable quantity. The surrounding bone is thinned with no evidence of new bone deposits, and extends as a rule up to the epiphyseal line. Histologically the marrow is seen to be replaced to a greater or less extent by fibrous tissue evidently formed from the endosteum, and there may be evidence of active bone formation and absorption. Giant cells may be formed in excess in the neighboring tissues. Culture of the fluid taken from the cysts has so far given a negative result.

Symptoms—Onset very gradual, pain usually absent, in cases of lower limb a slight limp being the first symptom elicited by the patient. This grows progressively worse. Tenderness on palpation may be well marked, and sometimes egg-shell crackling may be demonstrated, pathologic fracture or fracture from slight violence may result.

Diagnosis—X-ray may show trabecula formation, with expansion and thinning of the bone in the region of cyst formation. The clear areas may be prolonged down the shaft. The differential diagnosis between osteitis fibrosa, mye-

loma and other cyst forming conditions, and in some cases, tuberculous disease may be difficult or impossible.

Limitation of motion in osteitis fibrosa is merely that of the resulant deformity while in other conditions it is likely to be in all directions. In many cases diagnosis can only be made at operation ,and microscopical examination of the cyst membrane. In many cases only a guarded pathological opinion can be given.

Treatment—Operative, cutting through the bony shell so as to expose the affected area, which is then thoroughly curetted until all the affected tissue is removed. The resultant deformity should be corrected. Only two cases of death from hemorrhage have been reported. The old method of amputation seems to be unnecessarily severe.

Typical Case Report—C. M., male, twelve years, hospital, 1915. He had broken his arm after slight violence three years before and again a year later. Three weeks before attending hospital he had sprained his arm and worn splint, and a few days later fell and fractures it. There was no pain but on examination swelling the size of an egg could be felt below the neck of the humerus. X-ray examination showed a growth expanding the bone and thought to be an endosteal sarcoma. At the operation performed by Mr. Tagge a thin walled cyst with a definite lining membrane was found, and this was cleaned out and packed with decalcified bone. The material removed proved to be a blood clot, fibrous tissue, and marrow with an excess of normal looking multi nuclear giant cells. This patient had no further trouble with his arm and is quite well four years after operation.—*James R. Elliott, Kansas City, Mo.*

FOOT PROPHYLAXIS IN CHILDHOOD. J. Torrance Rugh. *Pennsylvania Medical Journal*, December, 155.

The author estimates that 98 per cent of foot disabilities in childhood are mechanical in origin and character. Of the bony changes, one of the most common is a hyperthrophy of the inner part of the scaphoid impinging on the head and neck of the astragalus. Instead of a hypertrophy, there may be a supernumerary bone in this same position. Both of these conditions cause a limitation in adduction of the anterior part of the foot so that the body weight falls too much to the inner side. This condition may be incurable. Two forms of treatment are advised. The heel and sole of the shoe may be built up on the inner side and a pad of felt or leather placed under the inner part of the longitudinal arch to produce an adducted position, together with exercises for strengthening the inner group of muscles. The other form of treatment is to remove the hypertrophied part of the scaphoid on the supernumerary bone, destroy the astragalo-scaphoid articulation transplant the tendon of the tibialis posticus farther forward on the internal cuneiform and hold the foot in extreme adduction in plaster for about two months, following which the shoes are changed and exercises given as in the conservative form of treatment.

A short tendo Achilles is responsible for disability in from 10 to 15 per cent of children. The pull of the shortened tendon rotates the os calcis turning the entire foot outward. The proper treatment is to lengthen the heel tendon and after firm union, massage and exercises of the muscles, the child being allowed to walk with inner edge of shoe-heel and sole raised. This usually requires about six months to restore muscle function and tone.

Prophylaxis in shoes and stockings for children is of great importance. Wool stockings on account of shrinking may cause quite appreciable cramping of the toes. They should be dried over forms to retain their proper size for the foot. The shoes are more frequently too short than too narrow in fitting children. It should be realized that a shoe will stretch in width but never in length. There should be at least half an inch between the end of the longest toe and the end of the shoe when the child stands up.—*William Arthur Clark.*

Obstetric Paralysis (Erb's Palsy) with a Report of Seventeen Cases. By Samuel W. Boorstein, M. D., N. Y. *Medical Record*, Vol. 96, No. 20, Whole No. 2558, November 15, 1919.

It is an established fact that in all forms of flaccid paralysis a great deal can be accomplished by orthopaedic methods, if treatments are begun early and contractures guarded against.

Etiology.—The review of literature of Sever shows that the majority of observers believe that Erb's palsy is due to a stretching or tearing of some of the roots of the brachial plexus caused by forcible separation of the head and shoulders during delivery.

Pathology.—There are two well recognized types of paralysis seen. The more common one consists of a lesion which involves the fifth and sixth cervical roots and the suprascapular nerve and produces paralysis of only the muscles of the upper arm with the exception of the supinators. This is known as the upper arm type. The less usual type, the so-called lower arm or whole arm type, is the result of injury, not only to the fifth and sixth cervical roots, but the seventh, eighth and possibly the first thoracic as well. Here the whole arm is flaccid; there is a wrist drop and paralysis of the small muscles of the hand. There rarely occurs the pure lower type of paralysis without any involvement of the upper cords of the plexus.

The nerve sheath in any overstretching process must give way before the nerve itself, as it supports the nerve. When the sheath is torn, as it always is in cases of birth palsy, the arterioles belonging to it and supported by it are ruptured, and a hemorrhage into the substance of the nerve and its sheath results. Were it not for the obstructive features of the repair process in the nerve sheath, we might expect a more or less complete recovery in the majority of cases. Four pathological specimens showed on study the following conditions: The usual seat of the lesion was at the junction of the fifth and sixth cervical nerves. The perineurial sheath presented many old dense pigmented deposits, the site of old hemorrhages. In some persons the perineurial sheath was

buckled inward on the nerve fibres, strangulating them and preventing their regeneration. Evidences of strangulation were present not only at these points, but also in the nerve fibres underlying these pigmented deposits. There was an obliteration of the myelin sheath above and below. In the more severe cases the strands of the plexus involved came to an abrupt termination in a mass representing an old organized hemorrhage. There was a severing of the nerve fibers, which were often thrown into fold for some distance from the primary lesion. Repair of the nerve sheath takes place before regeneration of the nerve fibers, and if this has buckled inward on the nerve bundles following relief of tension, the nerve fibers are inevitably going to be strangulated and their regeneration prevented.

Roentgen-Ray Findings.—In the first year there is usually nothing seen of bony deformity. There may be a slight posterior sub-luxation of the shoulder joint, but there is never any acromial deformity evident by roentgenogram or clinically. No case has been observed in which the epiphysis has been displaced so far as could be seen by comparison with the normal shoulder. The epiphysis, as well as the shaft of the humerus, is always smaller than the unaffected side which condition is undoubtedly due to atrophy from disuse. The scapula is practically always elevated and outwardly rotated, due apparently to the pull of the intact inward rotators and the levator anguli scapulae. As time goes on and the child gets older, one begins to see increasing evidences of bony deformity, occasionally more joint subluxation than at first, increasing outward displacement and elevation of the scapula, and acromial deformity. The deformity of the acromion consists of a bending downward and forward or a hooking of its outer end, which apparently have no bony resistance to meet as normally in the head of the humerus, projects downward in front of the subluxated and inwardly rotated head. This hooking seems to vary directly with the degree of posterior subluxation and inward rotation of the humerus and tends to increase as the child gets older, provided subluxation is present. No case has been observed in which there has been a total subluxation or dislocation of the shoulder joint backward. The clavicle usually is shorter and its curves are more acute than its normal follow.

The hand grasp is usually good and the child flexes and extends the wrist and fingers well. The later developments in the upper arm cases, as the child grows and gets older, with or without exercise and massage, are as follows: The persistence of the inward rotation and adduction deformity, the so-called policeman's tip position, the inability in most cases to fully or freely supinate, the inability to get the hand to the mouth without raising the elbow, due to inability outwardly to rotate, the inability to put the hand to the head or behind the back. In the lower arm type all these conditions hold, besides the additional ones due to the paralytic conditions of the lower arm and hand, resulting generally in a useless dangle arm. Atrophy of the muscles in these cases of obstetric paralysis is never very marked, except in some cases of the lower arm type. One never sees the extreme atrophy so noticeable in cases of infantile paralysis. The lack of marked atrophy is undoubtedly due to the fact that the nerve impulses are rarely fully blocked and that the muscles practically never, except in rare cases, wholly loose their entire enervation. Some normal nerve impulses

pass through the scar tissue at the side of the lesions owing to incomplete destruction or injury of the nerve, and so keep the muscle tone up to a certain point. There is always a definite shortening of the arm in all cases due to nerve injury as well as lack of use.

Diagnosis.—Look for a fracture of the clavicle or arm or a separation of epiphysis.

Look for tenderness and swelling about the joint and tenderness on pressure above the clavicle over the course of the brachial plexus. Tenderness in the axilla may also indicate and exudate about the lower portion of the plexus.

Look for inequality in pupils, as that without question implies an injury to the inner cord of the brachial plexus high enough up to cause stimulation of the sympathetic branch of the cervical sympathetic plexus, which sends off a communicating branch from the fifth cervical segment of the cord.

Look for a dislocation or subluxation of the shoulder posteriorly.

Prognosis.—The prognosis in all upper arm type of cases is good provided the case is watched from the start and treatments properly carried out. The patients are practically all able to raise the arm to the shoulder lever and can use the hand and lower arm well, except for varying degrees of supination. In the lower arm type the outlook is not so good, although many of the patients regain use of the upper arm in spite of the persistent paralysis of the lower arm and hand.

Treatment.—As to treatment, the upper arm type can, if seen early, be treated with support, massage and exercises. Those of the lower arm type usually have to be operated on for the repair of the plexus. If the upper arm type comes late for treatments, one has also to operate on and correct contraction deformities. Even in lower arm type one may try for a very short time conservative treatment and if no improvements are noticed in a few weeks, operation should be resorted to.

In order to prevent contraction of paralyzed muscles, it seems best to put the arm at rest in such a position that the stronger muscles cannot contract. This may be done by holding the arm in a plaster cast, or by use of a light wire splint.

Position.—The arm should be abducted to a right angle with the torso or perhaps a little elevated so as to approximate the injured nerve. The limb should be rotated outward and the forearm supinated. The hand can be tied to the upper end of the crib. Massage and exercise are of the greatest importance and should be done daily if possible. Where subluxation or dislocation exists it should be reduced. If contractions at shoulder are present one may try a first forcible stretching under anaesthesia.

Operation on the Plexus.—Repair of obstetrical injury to the brachial plexus is often necessary.

Conclusions.—Obstetric palsy belongs to the domain of orthopaedic surgery as any other congenital deformity of a limb.

2. Obstetric palsy should be treated on the same principle as anterior poliomyelitis and all the deformities should be watched and prevented.

3. The principle in peripheral nerve injuries to prevent overstretching and over use of the denervated muscles should be applied here and the weak muscle watched.

4. The shoulder should be put immediately in a splint or brace to prevent stretching of the deltoid and allow absorption of hemorrhage and repair of the damaged nerves.

5. In most of the cases the injuries to the nerves are not severe and if treated early will recover.

6. About three months may be allowed for conservative treatments in the early cases. If no marked improvement is obtained, an operation on the plexus should be resorted to.

7. Conservative treatments consist of: Proper support, massage and exercises. No use of resorting to the universal panacea, "electricity."

8. Taylor's operation on the plexus is very useful and should be performed after conservative treatments have failed.

9. The contracted pectoralis major, subscapularis and teres major should be cut by Sever's method if effectual results be desired.

10. A patient suffering from this affection should be under proper observation at least till the age of ten as slight deformity may persist.—*Leo C. Donnelly, Detroit.*

GUNSHOT FRACTURES OF THE TIBIA AND FIBULA. OBSERVATION ON THE PATHOLOGY AND TREATMENT. By Frederick Christopher, M. D., Chicago, Ill., Formerly First Lieut., M. C., U. S. A. *Annals of Surgery*, Vol. LXXI, January, 1920, No. 1.

By far the most satisfactory instrument, in the opinion of the writer, is the "skate" devised by Major M. Sinclair, R. A. M. C. This skate has been described by Colonel Blake and his associate, Captain Bulkley, as follows: "It consists of a block of wood a little longer than the foot and very slightly wider, in the free edge of which are cut about ten notches. This center contains a longitudinal slit through which passes a bolt provided with a thumb nut on the exposed side. The side of the board toward the foot is padded with cotton and covered with gauze. The transverse bar is made of iron 5 millimetres thick, 2 centimetres wide and 15 centimetres long, with a hole at the center and each end. With glue 8 or 10 narrow tapes are pasted along each side of the foot, each tape having previously had attached at the end toward the sole a small curtain ring. The bands over the dorsum of the foot do not meet in the midline, but leave a free area to prevent constriction and interfere with the circulation. The foot is fastened to the board by lacing the ring on each side to each other on the under surface of the board. The apparatus forms practically a ball-and-socket joint for the control of the position of the foot. The lower free edge of the transverse metal bar rests on the parallel bars of the (Hodgens) splint and maintains the position of the foot in the position in which it is placed. To elevate

or depress the foot as a whole (correct posterior or anterior angulation at the site of the fracture) the wooden block is slipped upward or downward on the transverse bar, and the thumb screw tightened. To abduct or adduct the toes (rotate the lower fragment inward or outward) the block is rotated on the transverse bar and there fixed. To evert or invert the foot as a whole (correct lateral angulation at the site of the fracture) the cord leading from one extremity or the other of the transverse is shortened. The 'skate' is especially useful in very low fractures of both bones and in fractures involving the ankle-joint."—*Leo C. Donnelly, Detroit.*

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THE OPERATIVE TREATMENT OF IRREDUCIBLE PARALYTIC DISLOCATION OF THE HIP JOINT

ELLIS JONES, LOS ANGELES

In 1913, Albee proposed an operative method of retention of the femoral head in dislocations of the hip where the acetabulum is shallow and the hip will not stay in place after a reasonable trial by the bloodless method. By this operation a superior curved lip of bone is turned down to overhang the deficient acetabulum and maintain the reduced femoral head. The position of the overhanging lip or rim is maintained by tibial bone grafts. This method the writer has used successfully in four cases of simple paralytic luxation of the hip joint. In these cases before operation the luxation could be reduced and created at will. The operation included reefing the capsule, and was followed by plaster fixation for from three to five months. Sufficient muscle activity was present to give good functional hip joints without anchylosis and with excellent stability.

The writer's interest in the application of this method to so-called *irreducible* paralytic dislocation of the hip joint was acutely stimulated in August, 1917, in the study of the following case:

W. R., male, age 18. Student. Infantile paralysis at eighteen months. Examination showed an extreme flexion adduction deformity of the right hip with nine and one-quarter inches of apparent shortening. The trochanter was four inches above Nelation's line. (Plate 1.)

The head of the femur could be seen and felt high up on the dorsum of the ilium. The adductors were strongly active and contracted. The abductors were overstretched, atrophied, and apparently paralyzed. The ilio-psoas was active and con-

tracted, together with the tensor femoris and sartorius. The glutei were inactive. The right knee-jerk was absent, but voluntary extension and flexion persisted at the knee. The peronei and tibalis anticus were inactive, and the foot was held in moderate equino-cavus.

The radiograph (Plate II) showed a high iliac dislocation with moderate coxa valga and practically no acetabulum, malformation of the femoral head, and marked atrophy of the shaft and right pelvis.

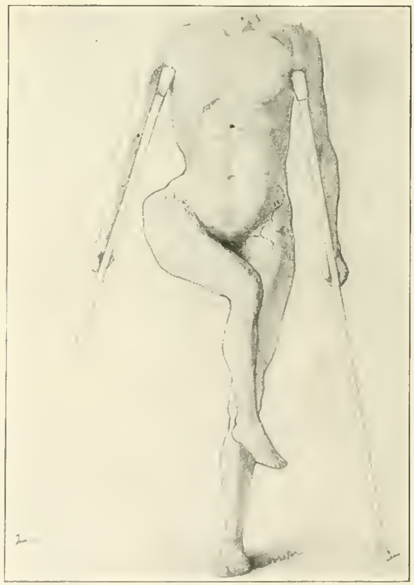


PLATE 1

Paralytic Dislocation of the Hip-Joint of 17 years duration. Note the flexion adduction deformity; the real and apparent shortening of the leg with loss of function and weight bearing.

The patient gave a history of persistently increasing deformity, futile brace support, and no attempt at weight bearing, having always been on crutches.

Diagnosis: Irreducible iliac dislocation of hip, of seventeen years duration, following infantile paralysis at eighteen months.

The factors therefore operating against reduction in this case may be classified as follows:

I. A deficient, almost absent, acetabulum.

II. A malformed distorted head of the atrophied femur.

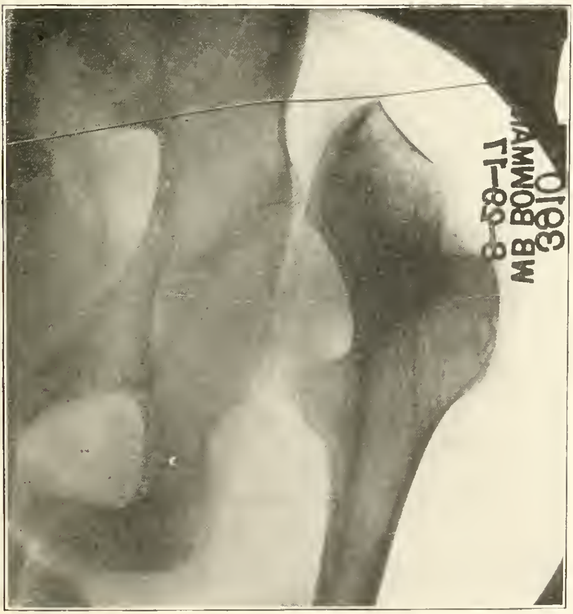


PLATE 2

Note the deficient, almost absent acetabulum; the infantile atrophied femur with distortion of the head and coxa valga.

III. Contracted non-paralyzed muscle groups which pull the head of the femur away from the acetabulum—the ilio-psoas, adductors and flexors.

IV. An overstretched relaxed joint capsule insufficient of itself to maintain reduction if obtained.

V. Apparent shortening of the large nerves and blood vessels.

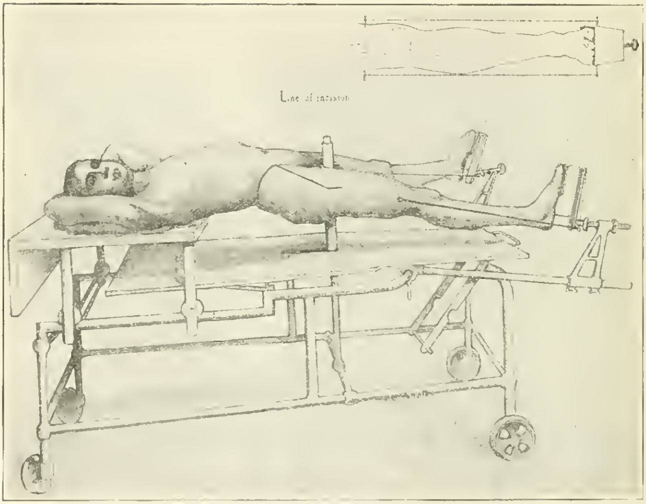


PLATE 3

Patient on Hawley table with traction obtained by Steinman nail through lower third of femur.

Hoffa maintains that it is impossible to reduce long-standing paralytic dislocations of the hip because of probable rupture of the shortened nerve trunks and blood vessels.

Schultz, quoted by Sever, made two unsuccessful attempts at reduction. In one case the neck of the atrophied femur was fractured.

Cramer reports a case—also paralyzed at eighteen months—and at twelve years the left leg was flexed, contracted, and the femur dislocated. Attempts at reduction, after cutting the contracted muscles were unsuccessful.

Rehn anchylosed the hip in a new acetabulum in a child of sixteen years.

Dollinger drove a long screw through the trochanter and neck of the femur into the bottom of what remained of the deficient acetabulum. A nut was then placed upon the internal end of the

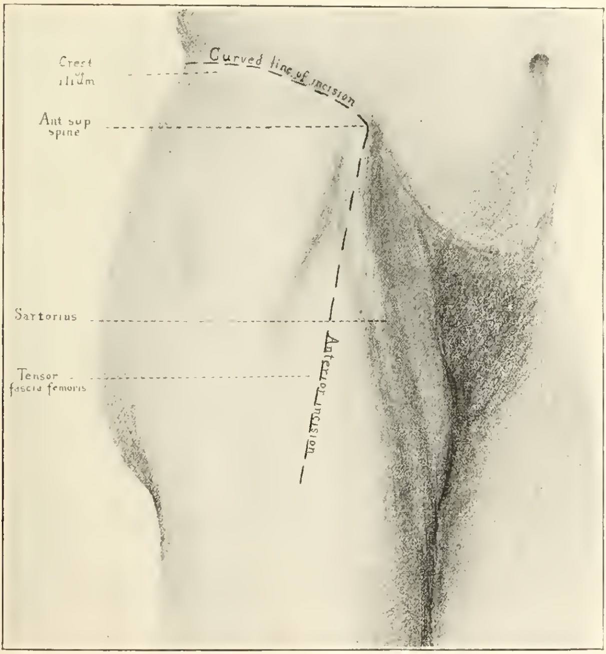


PLATE 4

Showing line of incision for sub-periosteal approach to the hip-joint.

screw by means of an abdominal incision giving access to the interior of the pelvis, and another nut was placed on the outer end. This case is reported as a good result but Vulpius naively remarks that the severity of the operation deters others from attempting it.

In view of the satisfactory results obtained by the writer in simple luxation, by Albee's method, operation was planned accordingly with several simple modifications. Since with the apparent exception of the glutei paralysis, there was excellent muscular activity in the hip, it was decided to try for a reduction *with motion and function.*

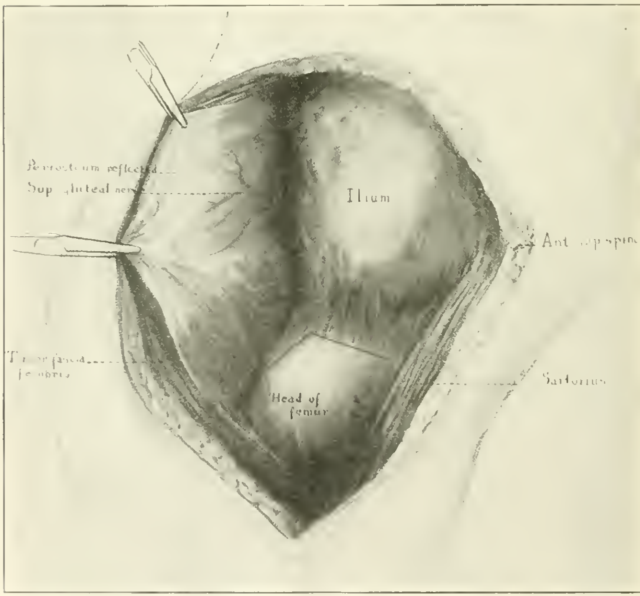


PLATE 5

The sub-periosteal reflection of the glutei with free exposure of the ilium, the superior rim of the acetabulum and capsule of the hip-joint. It is this approach of Smith-Peterson's that promises to greatly simplify the operative technique of hip-dislocations.

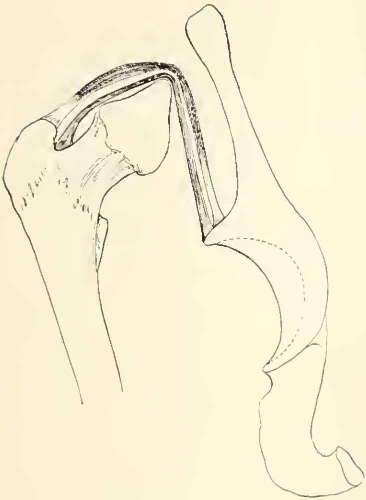


PLATE 6

Schematic drawing of a persistent paralytic dislocation. Note the overstretched atrophied capsule and trochanteric muscles, the deficient atrophied acetablum, the distorted femoral head. The dotted line indicates the approximate depth of the normal acetabulum.

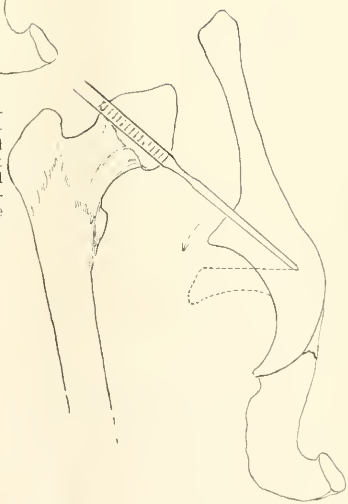


PLATE 7

Turning down a superior bony lip to form an efficient acetabular roof.

Operation August 30, 1917. Ether anesthesia. The patient was put on a Hawley table, and direct skeletal traction obtained by a Steinmann pin inserted above the condyles of the femur. Two metal chains connected the pin and the Hawley foot piece. An assistant regulated the traction at command of the operator. (Plate III.) The flexion adduction deformity was first corrected

Plate 8

The roof turned down and a notch prepared for the tibial transplant.

by open tenotomies of the ilio-psoas and adductors, and extensor femoris. The Smith-Peterson incision gave excellent exposure of the ilium and acetabulum. (Plates IV and V.) This iliac incision was curved to three inches below the trochanter, and the trochanter was removed with a wide osteotome. The capsule was split longitudinally; the head of the femur exposed and remoulded, care being taken to remove none of the weight-bearing cartilage. The acetabulum was rudimentary and entirely filled with fat and areolar

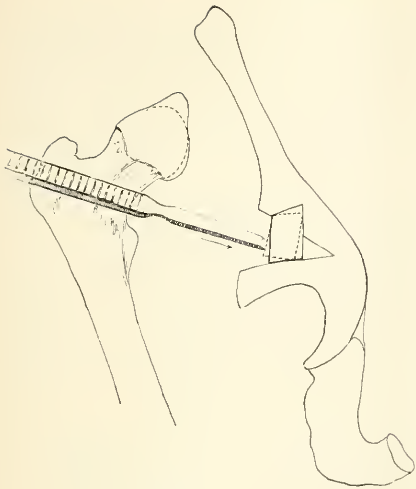


PLATE 9

The tibial transplant being forced into place. The head of the femur is remoulded.

PLATE 10

The dislocation reduced and maintained by the now sufficient acetabulum.

tissue which was removed together with a thin fibrous cord the remains of the teres ligament. The joint capsule was represented by an extremely thin overstretched membrane peritoneum-like in thickness. The acetabulum barely admitted the tips of the first two fingers. (Plate VI.) Skeletal traction was very carefully obtained at intervals, and pulsation of the femoral artery watched.

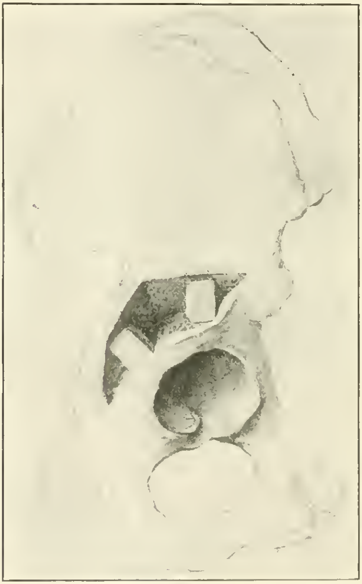


PLATE 11

Showing the position of the two tibial grafts used in the author's case.

The head of the femur was gradually brought down to the level of the acetabulum. There was no evidence whatever of circulatory disturbance although the traction seemed extreme. Traction followed by equally gradual abduction engaged the head at the edge of the acetabulum. With a chisel, a four-inch curved lip of bone

was turned down and outward approximately one inch above and behind the acetabulum, forming a curved roof about one inch in width and thickness. (Plate VII.) A tibial graft three inches long and three-quarters of an inch in width was obtained from the right tibia, and cut in half. These transplants were shaped by the motor saw, and inserted above and behind the newly-formed acetabular roof. (Plates VIII to XI.) The trochanter was replaced and held with a kangaroo suture, and the relaxed capsule reefed with two similar mattress sutures. The soft tissues were closed with chromic and catgut without drainage; the Steinmann pin was removed, and a long spica applied, from the toes to the nipple line, in thirty degrees abduction. The convalescence was uneventful. The plaster spica was changed to a short spica at the eighth week. All fixation was removed after the sixteenth week, and massage, muscle training, and active motion begun. The pa-

PLATE 12

Radiograph taken four months after operation. Note the capable acetabulum, the distinct outline of the new joint, and the position of the transplants. Compare with Radiograph in Plate 2.

tient was examined seven months after operation, and demonstrated seventy degrees of voluntary flexion. He walked with a cane and high shoe to compensate for an actual atrophic shortening of only four and one-quarter inches. (Plates XII and XIII.) September 20, 1919. Patient reports by letter—two years after operation—that he has entered agricultural college, runs a tractor, and walks without a cane. (Plate XIV.)

PLATE 13

Showing patient 7 months after operation. Dislocation reduced, firm painless weight bearing and 70° motion in hip-joint.

CONCLUSIONS.

I. In certain selected cases of so-called *irreducible* paralytic dislocations of the hip, we can give correction of deformity *with function.*

II. Hoffa's belief, based on experiments on the cadaver, that rupture of the blood vessels and nerves must occur in old long-

standing cases before surgical correction of the shortening can be obtained, does not hold true in the living.

III. Muscles in paralytic hips that are able by their contractures to perpetuate a dislocation at the hip are also able to perpetuate function if the dislocation can be reduced. Arthrodesis should not therefore be the method of choice except in flail hips.

In the preparation of this paper, the writer is especially indebted to J. W. Sever's study of "The Causes and Treatment of Paralytic Dislocations and Subluxations of the Hip-Joint," Boston Medical and Surgical Journal, Vol. CIXV, No. 9, pp. 313-323, August 31, 1911. It is the best article so far on this subject, and his bibliography and references have been freely used.

PLATE 14

Radiograph 2 years after operation. Note the well developed acetabulum, the distinct outline of the joint, and the hypertrophied femur. Compare with Plate 2.

POINTS TO BE OBSERVED IN THE FIRST TEN DAYS OF THE TREATMENT OF COMPOUND FRACTURES.

BY H. WINNETT ORR, M. D., LINCOLN, NEBR.

Presented in Abstract at the Annual Meeting of American Orthopedic Association, 1919.

There are two things to be done in the treatment of all fractures. First, to restore injured parts to their normal relationship; second, to maintain the parts in this normal relationship until healing occurs. Ultimate function must be as carefully considered as final anatomical position.

It should hardly be necessary even to mention these points much less to discuss them in detail. In an extensive experience with compound and simple fractures, however, I have found these points regularly disregarded. It may be said that there are a few surgeons who are willing to debate the importance or the necessity of observing either or both of the above rules. In general, however, the principles are accepted as true even if they are not observed in practice.

The best position we can get after any fracture and the sooner we can get it I hold to be of primary importance in securing good results be the fracture simple or compound. Also the most perfect immobilization that can be obtained after securing normal relationship of injured remaining parts is still none too good if we desire early and rapid healing.

Any argument for promoting bony union by rubbing together the ends of fractured bones is not only probably wrong in itself, but is bad teaching for practitioners whose methods of immobilization and splinting may already be inadequate.

Our military experience taught us several things about the treatment of compound fractures. We learned that by the simplification of apparatus large numbers of surgeons, even those without previous experience in fracture surgery, could be taught to do excellent work in a short time. We learned that with the Thomas Splint properly applied femur and leg fractures could be immediately adjusted and that with proper attention afterwards

the same splint could be made efficient in carrying the patient through to complete recovery.

We have long since learned the value of plaster of Paris applied by the Whitman method in cases of fracture of the neck of the femur. A proper line is established for the neck of the femur and immobilization for a sufficient length of time is maintained.

In line with the above and contrary to the impressions of the first three years of the war we found that we could send pa-

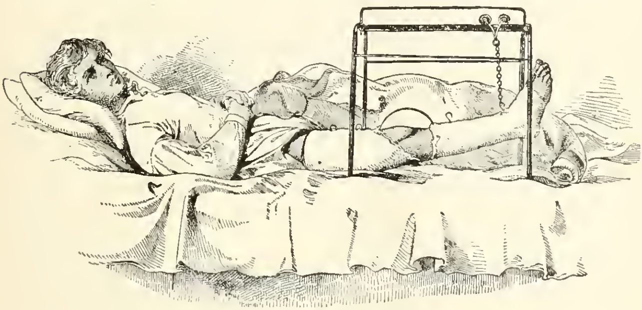


FIG. 1

Shows apparatus applied to limb, and slung by the ankle-hook of suspension-rod from a Salter's Swinging Cradle. Two or three other hooks for suspension are introduced; although sometimes useful, as affording a sense of change of position to the limb, they are not material to the apparatus.—*From "Excision of the Knee Joint," by P. H. Watson, M. D., Edinburgh. MacLachlan & Stewart, London. Robt. Hardwicke, 1867.*

The above is an apparatus of which the Balkan frame is a worthy successor. The results reported by Dr. Watson are also excellent.

tients with compound femur and leg fractures from France to the United States in plaster of Paris. Plaster of Paris proved also a great advantage even in open fractures of the upper arm and the elbow.

In this latter class of cases we had at Savenay one of our most interesting experiences. We found that a great many of our patients came directly or indirectly from the front with fractures of the humerus often involving the elbow joint. These patients came in the straight Thomas splints with elbows straight and hands pronated. We saw them from a few days to sixteen weeks

after injury. Neither normal relationship nor immobilization had been obtained in most of these cases.

Following the teaching of General Sir Robert Jones the rule was made that every such arm was to be taken out of its straight Thomas splint, the elbow flexed, the hand supinated and dorsiflexed. (Exception to supination of the hand was made in a few cases in which the patients expected to be employed later with the hand palm downward upon a table.)

After such manipulations the arm was fixed in plaster of Paris, many times with a body cast, or carefully bandaged into a Jones humerus traction splint or an aeroplane splint. In some cases where there were especially large wounds the patient was put to bed and the arm suspended by the humerus hammock with the arm flexed and hand extended in a Balkan frame as taught by Col. Joseph A. Blake in Paris.

One of the points which it is desired to clear up in this connection is the distinction between the use of weights and pulleys purely for suspension in the Balkan frame and their use as a means of securing traction. In our work at Savenay weights and pulleys were rarely used for traction. They were often used, however, in the Balkan frame for arm and leg suspension or as an aid to the patient in lifting himself from the bed for surgical dressing and other purposes.

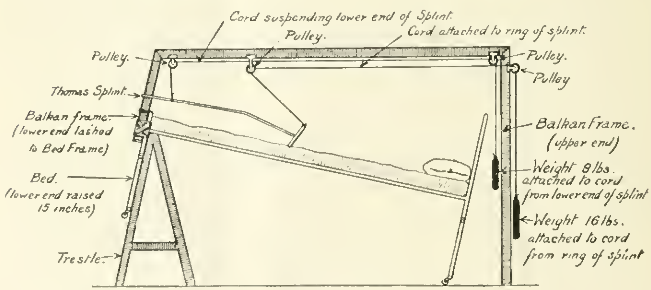


FIG. 2

From Statistical Report (British) No. 2 1918, Medical Research Committee, Method of Major M. Sinclair, R. A. M. C.

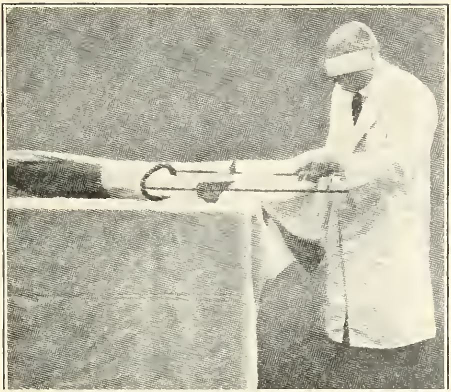


FIG. 3

Introducing limb through ring of knee splint.

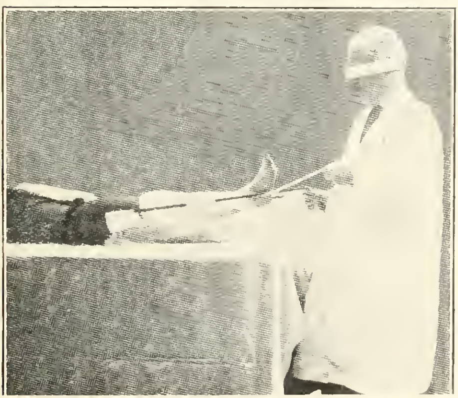


Fig. 4

Method of application of the Thomas splint. Knee splint in position, traction applied.

From "The Mechanical Treatment of Compound and Suppurating Fractures Occurring at the Seat of War. By General Sir Robert Jones.

Any amount of traction necessary whether for femurs or other portions of the body can be obtained by the proper use of the Thomas splint. As pointed out on one or two previous occasions we were able even up to sixteen weeks in some cases entirely to overcome a shortening of two and one-half inches in compound femur fractures by the use of the Thomas splint according to the technic laid down by the British. This technic as employed at Savenay was described in detail in a circular issued at Savenay in 1918 and since published in this country.*

What the writer hopes is that our American surgeons and especially our American general practitioners, will discontinue the use of methods which have to commend them only the fact that they have been used successfully by a few surgeons who became skillful in a particular method. All others should unite upon methods which have been shown to be universally applicable.

The treatment of fractures is a sufficiently difficult undertaking when done the easiest way. There are plenty of instances to show that only a few surgeons regularly succeed in getting good results with some of the "personal" methods now in vogue. In the hands of a few men Hodgen splints, the Ruth Maxwell method,

*The Thomas splint should be applied and cared for always in the same manner. The introduction of individual methods invariably leads to a loss of efficiency, as patients pass from the hands of one surgeon or hospital to another. The following points must be observed. A long splint and a well-fitting ring must be selected. It must be bent to an angle of 10 to 15 degrees at a point 1.5 inches above the level of the knee-joint. Having regard for wounds, the adhesive traction bands (of Sinclair glue or moleskin plaster) must include as much skin of the leg and thigh and extend as high as possible. The traction ropes for twisting attached to the lower end of the adhesive should be of 0.25 inch rope or of 4 ply muslin, fastened very securely into the adhesive, so that it will not give away under a pull of even 15 to 20 pounds. Muslin hammocks of not more 4 inches in width should be placed across the splint for its entire length at a sufficient tension so that the leg rides well on the top of the splint. The splint is then put on and the traction straps tied firmly over the lower end with the ring tight against the tuberosity of the ischium. A right angle foot piece is put on and the foot and knee bandaged in such a way as to put the entire extremity at rest in the splint. The twisting of the traction bands should have attention once or twice daily. The lower end of the splint should be tied to the outer end of the foot of the bed in such a position that the lower end of the femur rotates slightly outward. The foot of the bed should be raised 12 inches so that the patient's body acts as a counterweight to pull against the anchored splint. By following exactly this technique it has been possible at Savenay to demonstrate an average gain in length of more than 3 centimeters in a series of over 300 cases. In dealing with open wounds in this splint, it is only necessary to release one or two of the 4-inch hammocks. Care must be taken so that the entire area of the fracture is not moved or allowed to sag below the level of the normal anterior curve of the femur.—*From Surgery, Gynecology and Obstetrics*, November, 1919.

the Buck's Extension method and even weights and pulleys with long sand bags have given good results.

In the hands of the man who is using any of these methods for the first time, however, or who has occasion to use them only once a year we know how poor the results can be. Anyone can be taught to use the Thomas splint properly and to apply it to all kinds of cases within a few hours or in an experience of a few cases. It adapts itself even to home care without much difficulty.

It is greatly to be hoped that the four or five standard splints which were used throughout the A. E. F. will come to be generally used in this country and that most of the other methods and forms of apparatus will be entirely discontinued. Even the individual modifications of these standard splints usually detract from rather than add to the serviceableness of the apparatus.

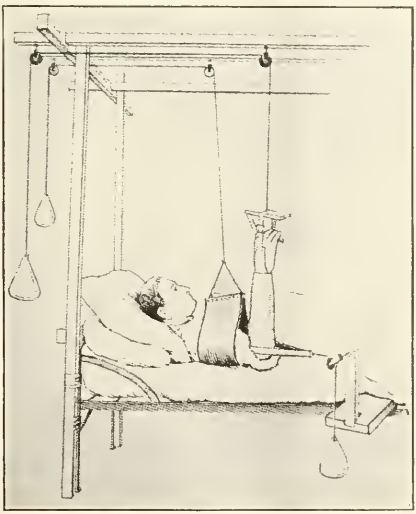


Fig. 5

To illustrate a simple method of obtaining abduction and traction by means of a rough board slipped between mattress and bedspring and holding by friction.—*From "The Treatment of Fractures by Suspension and Traction. Surg., Gyn. and Obstet., Mar., 1918, by Dr. Jos. A. Blake and Dr. K. Bulkley.*

Discussion.

Dr. John Ridlon of Chicago said that the first Thomas hip splint made in this country was made by him in his cellar. They were used afterwards at St. Luke's Hospital, New York. He felt sorry that the Thomas splint as used in the army was not exactly the splint devised by Thomas, and recommended by Jones. Dr. Ridlon said that he had seen 2½ inches of communited femur involving the great trochanter, and an oblique fracture in the middle of the shaft, with overlapping, and yet after proper use of the Thomas splint the leg was as long as the other.

He demonstrated a loop used with the Thomas splint, passing over the shoe for traction and around the ankle. The hitch is made by forming a loop with a piece of bandage, and then drawing a second loop from one end of the bandage through the first loop. The first loop is placed around the ankle; the second loop goes under the arch of the foot. This hitch was not described in the splint manuals, and is more quickly made than any other.

Dr. Ridlon said he would like to ask the men from overseas if they had found it possible to elongate fracture of the femur during the first two weeks of the healing process. Could the connective tissue be stretched in the same way as granulation tissue which goes with healing of wounds, such as burns. He had heard this had been done in France. It would seem an important question.

Dr. Joel E. Goldthwait of Boston said there was no question as to the feeling of efficiency represented by the Thomas splint with the American Expeditionary Forces, and this feeling was shared very much by the other armies, especially the British.

At a meeting of the Medical Officers of the American Expeditionary Forces held in Paris under the auspices of the American Red Cross, a demonstration of the Thomas splint was made, and at this meeting the director of the British Forces was present and shared in the discussion. He stated that this one splint had undoubtedly saved more lives than any one piece of apparatus, and that in their Army they had begun to call it the "St. Thomas" splint.

Various modifications have been suggested, but they have been discouraged quite largely because while the Thomas splint itself is almost fool proof in its application, the modifications all practically involve special understanding.

In the use of the Thomas splint it should be remembered that while it is relatively possible to get lateral alignment in the cases of fractured femur, that there is a tendency for the upper fragment to drop downward so that the normal anterior curve of the femur is lost. By adjusting the pads under the seat of the fracture, it is possible to raise the fragments and correct this feature. It should also be remembered in putting up a fractured femur that the upper fragment always drops downward, and consequently rotates outwardly slightly. For that reason the lower fragment with the foot and leg should be put up with the lower leg rotated outwardly somewhat so that the toe instead of pointing straight up will point outwardly about 20 degrees.

Dr. A. H. Cilley of New York said that if one wanted to get elongation with the Thomas splint or anything else, one had to have a man working twenty-five hours a day. We had such a man in Lt. Davis at Savenay, but he did not know many men who could do it.

Dr. R. R. Fitch, Rochester, N. Y.: One should make an attempt to turn compound fractures into simple fractures. It is not possible to do this unless the cases are seen early. Primary suture may sometimes be done but secondary suture is usually preferable.

The condition of the wound should be checked up by laboratory findings, the bacterial count being not as important as the information obtained by

cultures. When the wound is free from anaerobic bacteria and streptococci, it may be safely closed even though there are a few staphylococci present.

Dr. Robert Osgood of Boston said that he confessed to ignorance of the proper use of the Hodgen splint when it was illustrated in the manual of splints and appliances for the Medical Department of the U. S. Army. High oblique suspension was the keynote of its use and traction was thus obtained. Many men had objected to the Thomas splint because they found that it caused pressure on the ischial tuberosity. It is possible to remove this objection. The first point is that the ring must be smooth and covered with leather. A splint covered with hose pipe and padded with cotton makes it impossible to maintain continuous counter extension. The ring must be covered with leather well soaped and absolutely smooth. The acute pressure point may not be more than the size of a ten-cent piece. If you can change that pressure often, you can make the patient comfortable, and avoid sloughs by moving the leg, for example 6 inches to the right in the morning, and 6 inches to the left at night. Movement through an arc of a few degrees will largely avoid pain and pressure. With some sensitive skins these slight changes are not enough to relieve pressure, but if in addition to that a 5-pound weight is attached to the end of the splint and suspended over a pulley at the end of the bed, the pressure is removed a fraction of an inch from the tuberosity. Proper technic and familiarity with its use will, he believed, remove objections to the use of the Thomas splint.

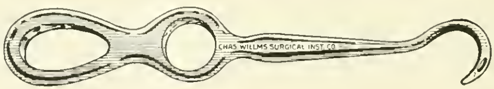
Dr. Osgood said it was a difficult thing to measure femora, especially with osteomyelitis, a heavy dressing and with a Thomas splint in place. To keep track of femora with dressing on, a simple device was worked out. A yard stick with a piece of sheet steel 4 inches by ½ inch screwed at right angles to one end and with a similar piece on a sliding arm was used. The fixed end was hooked over the anterior superior spine, and by sliding the arm along to the malleolus one could measure the limb over the dressings and splint.

INSTRUMENT FOR TENDON FIXATION

BY G. E. BENNETT, M. D. 4 E. MADISON ST., BALTIMORE, MD.

Feeling that a firm implantation of a transferred tendon was a very essential point of technique and that we might accomplish this by the simplest possible method, this instrument has been designed. It has been given the nick-name of the "button-hook" on account of its shape which is almost identical with that useful article.

The hooks are made in three sizes, diameter of the hook section being one-half, five-eighths and seven-eighths inches respec-



tively, the total length of the instrument eight inches. It has a cutting edge and an eyelet large enough to accommodate the tendon as shown in the accompanying cut. With this one is able to drive the sharp point through ligaments and into osseus structures and by carrying the handle in an arc bring the point out through the tissues, insert the tendon through the eyelet and draw it through bone and ligaments so that it can be re-attached to itself or firmly to the tissues at the exit of the tendon.

THE ORTHOPEDIC LABORATORY AS A SOLUTION OF THE BRACE PROBLEM.

BY DR. J. E. M. THOMSON, LINCOLN, NEBRASKA.

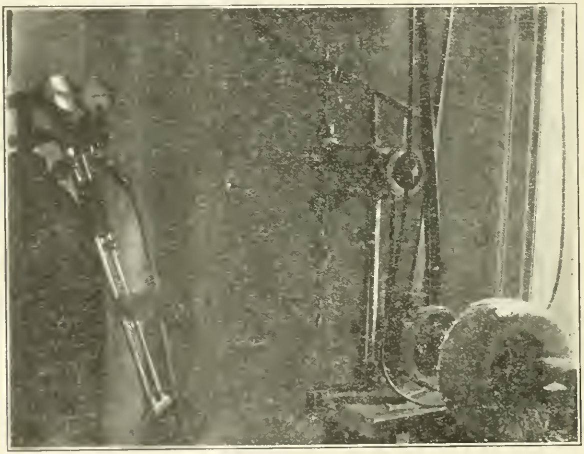
One of the problems confronting the orthopedic surgeon, especially in the smaller cities, is that of obtaining adequate orthopedic appliances and braces that seem to meet his particular needs; also the delay involved and the tedious multiplicity of appointments necessary before an order can be satisfactorily filled. At one appointment he must measure his patient or make the required casts, then send to another city for the desired appliance, waiting several days or weeks for its arrival. At a second appointment the brace is applied. If alterations are necessary the brace must be returned and a third appointment made. These frequent professional visits, especially when made from a distance, often cause dissatisfaction to the patient and embarrassment to the surgeon.

Prior to entering the army, my only effort to gratify my desires in regard to adequate braces lay in the use of removable plaster jackets and pelvic casts in vertebral and sacroiliac disorders, and certain shoe alterations for foot conditions. However, at the time the base hospital in France—to which I was attached as orthopedic surgeon—began receiving patients, it was practically impossible to procure splints from the local supply depot. Therefore it became necessary to buy on the open market, in neighboring French towns, equipment for a workshop or, as I designated it, an "orthopedic laboratory." Here, with a full-time man in charge, were made not only numerous splints, of the ordinary type prescribed by the U. S. A. Orthopedic Council, but many other braces and appliances which seemed to meet the local needs most advantageously. In fact, with the exception of a few Thomas leg and arm splints, we did not find it necessary to call on the medical supply depot for any brace materials.

It was this experience which led me to believe that to practice the art of orthopedic surgery successfully it is necessary to have a "personally conducted" or supervised laboratory where the surgeon can display his own eccentricities, good or bad, and where adequate, rapid and efficient service can be rendered to the patients. To a certain extent, of course, the exception to this rule lies in the

opportunities presented to surgeons in large cities, where the commercial brace-maker is almost a part of *his* orthopedist's own machine.

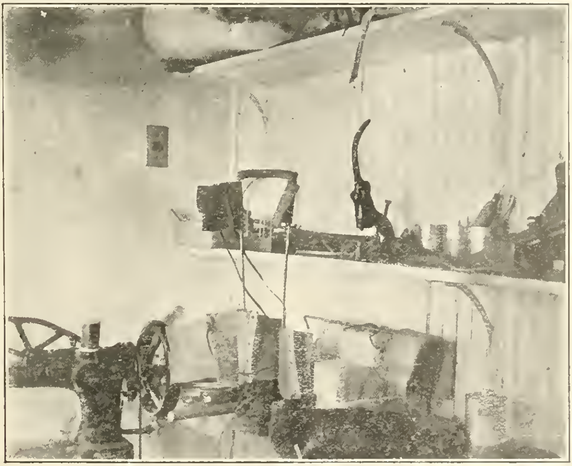
It is a real satisfaction, therefore, to have on my return to private practice an orthopedic laboratory in connection with my office. Such a venture, in modest form, is not beyond the reach of anyone. The initial expense of equipment and upkeep is totally



Due to the small space illustrations are very difficult to obtain. However this corner shows the end of the polisher and the power drill driven by the same motor. Also the oxyascetyline welder and boot jack.

overbalanced by the benefits derived. Lack of space has made it necessary to confine my own department to an area six by nine and one-half feet, in one end of my plaster room, and separated from it by a seven-foot partition. As the window at the laboratory end is large and the light excellent, the half-partition does not interfere with the adaptability of the plaster room (nine and one-half by twelve feet) for all ordinary office plaster work, nor with its light and ventilation.

The equipment includes a pair of work benches running the length of the room on either side. On the one is an ordinary power polisher and finisher such as may be seen in any up-to-date shoe repair shop; and from the same motor (one-third horsepower) is operated a light drill. The opposite bench, with shelves above and vises attached, is used for all work purposes. At one end is a cabinet for the storing of materials; at the other a boot-jack and leather stitching machine.



Another corner of the shop, showing work bench and leather stitching machine.

The latest and one of the most helpful requisites of such a labratory is an oxyacetylene welder, with which both bending and welding can be done with ease and safety. The above, with the various small accessory tools, embrace practically all that is necessary to the manufacture of almost any simple brace.

The work of the laboratory is performed by myself and an assistant. It is our intention to furnish prompt service, and whenever possible, day service. By this I mean that measurements are taken, fittings made and braces completed on the day when patient presents himself for measurement. We make no attempt to gratify

the aesthetic temperament by elaborate and glittering contrivances. On the other hand, every effort is made to simplify the apparatus and to turn out braces that are well fitting, comfortable, durable and neat, either enameled or leather covered.

The following constitutes the full list and cost of equipment:

1	Progressive polisher and leather polisher, with 1/3 horse-power electric motor	$100.00
1	Bench power drill	20.00
1	Progressive boot jack	12.00
1	Leather stitching machine, Singer	95.00
1	Universal oxyacetelyne welding outfit (complete)	49.50
1	Vise with anvil end	6.00
1	Universal eyelet set	2.50
2	Leather punches at $1.00	2.00
1	Cobbler's hammer	.60
3	Leather knives at 25c	.75
	Awls and needles, assorted	.50
3	Nail nippers at $1.00	3.00
1	Mechanic's hammer	1.50
3	Files at 25c	.75
1	pair pliers	1.50
1	Pair tin shears	2.50
1	Hack saw and blades	2.00
4	Steel drill points	1.00
		$301.05

With the above list of equipment, which demands an expenditure of only about $300.00, can be manufactured all manner of spine, leg and arm braces and splints, as well as other orthopedic appliances.

Cold rolled round steel shafting is used, and is preferred for arm and leg apparatus, such as the Thomas and other arm and leg splints and braces of the calliper or side iron variety, the size of the bar depending upon the length of the splint and the stress brought to bear. One-fourth and five-sixteenths inch diameter generally meet most of the requirements. For cuffs and retaining elements galvanized iron is used. In the manufacture of spine and sacro-iliac braces, strap iron of various widths (½ to 1½ inches) and thickness (1/16 to ⅛ inch) is used for the less flexible sup-

porting portions, and galvanized iron and sheet iron are used where flexibility is desired. For padding, ordinary harness felt is used, neatly covered with leather. On certain back braces we use an inner facing of fine white or tan felt, stitched to an outer leather covering. Our experience has been that the best and strongest leather is always the cheapest, and that closely placed lacings are always preferable to buckles and straps. Most of our leg and arm apparatus is successfully made from measurements, but a plaster of Paris torso is practically essential for all body braces.

Though my laboratory "technician," as well as myself, are but novices in this work, we have learned to turn out wearable and adequate splints and braces at a relatively low cost, making the laboratory not only a paying proposition but a valuable asset to my orthopedic practice.

SOME POST-WAR ORTHOPAEDIC PROBLEMS

BY E. MUIRHEAD LITTLE, F. R. C. S., LONDON.

Presidential Address to the British Orthopaedic Association. November, 1919.

GENTLEMEN:

When I last year had the honour to address you the country was still at war and the great advance which ended in the armistice had not begun, nor was it even hoped for so soon by most of us.

The difficulties of a state of war were great but they were simpler than the difficulties and the problems of peace. We are now but little concerned with the treatment of recent gun-shot injuries but for years to come we shall have to treat the injured and crippled pensioner, and the remote results of wounds and disease incurred in or near the fields of battle. It will be the duty of the members of our association to continue to lead surgical opinion in these matters.

How far the methods found useful in the treatment of recent war injuries are applicable to the surgery of peace is a question which will require consideration. For instance in the treatment of compound gun-shot fractures of the long bones in the Special Surgical Hospitals it has been found generally possible with the improved methods at our disposal, to do away with all shortening not due to actual loss of bone. I have been told that in some cases the limb has even been unduly lengthened by traction. It is probable that the extensive damage to muscles which is so common in gun-shot injuries is the factor which has facilitated these results. Will equally good results be possible in the treatment of fractures in civil life by similar methods?

This is a question which will have to be answered by orthopaedic surgeons, so that the conditions governing success and failure may be properly estimated and in case of failure to attain ideal results the reputation of civilian surgery may not be unjustly tarnished.

For years to come the stumps of the survivors; of some fifty thousand wearers of artificial limbs will offer cases for treatment; and if the operations introduced by Vanghetti and the special pros-

theses for them prove of practical value there will be a host of operations necessary to kinematise many of these stumps.

It is to be hoped that the discussion which is presently to take place will throw light on the possibilities of the method.

The problems involved in the operative treatment of the disabilities resulting from Spastic Paralysis need discussion and elucidation. The hopes entertained when posterior rhizotomy was first adopted as a means of treatment have scarcely been fulfilled, and other proceedings seem to offer better results.

Here again we may hope this morning for light and leading in Mr. Bankarts' paper and the discussion thereon.

We do not know how many cripples there are in this country and it is most desirable that a census should be undertaken comparable to that made in Germany and reported by Biesalski before the war. It is almost certain that a large number of cripples have hitherto failed to receive effective orthopaedic treatment, and it appears quite certain that with the assumption by the government of greater responsibility for the Public Health, there will be an increase in the facilities for treatment throughout the country and a corresponding increase in the number of surgeons interested in orthopaedic surgery, all of whom should be members of our Association.

I have touched on a few of the orthopaedic problems of peace, but there are still others and no orthopaedic Alexander need sigh for new fields of conquest for a long time to come.

DISCUSSION ON CINEPLASTIC AMPUTATIONS
BRITISH ORTHOPAEDIC ASSOCIATION

November, 1919

OPENING REMARKS BY THE PRESIDENT, MR. E. MUIRHEAD LITTLE.

When in 1896 the Italian dream of African conquest melted away in the disastrous conflict with the Abyssinians at Adowa, a number of the mutilated victims of the brutality of the victors reached Italy.

For although the Abyssinians like the Boches profess and call themselves Christians they treated their enemy wounded with horrible barbarity.

Eviration, i. e., amputation of the external genitals was carried out on numbers of prisoners together with amputation of the hand or hands.

When the survivors of these unfortunates reached Italy, their condition naturally excited widespread pity. For the evirated no prosthesis was applicable but surgical and mechanical attention was directed to the provision of artificial limbs for those who had lost hands or feet. In 1898 Dr. Guiliano Vanghetti of Empoli in Tuscany, then a general practitioner, conceived the idea of so modifying the stump by operative measures, as to enable its intrinsic muscles to be harnessed to a prosthesis and thus to activitate the artificial segment.

Former methods of producing movements in artificial hands and fingers depended upon efforts made by the upper arms and shoulders; this principle appears to have been first used by Bailif in the middle of the last century and an elaborate example of the method is to be seen in the Carnes' arm.

Dr. Vanghetti is not a surgeon and he had no opportunity of putting the suggestions of his fertile brain into practice, but he performed many experiments upon fowls and during the last twenty years his writings have stimulated surgeons to put his principles into practice. To all such procedures he applied the term "Cinematization" or cinematic plastic. His suggestions were disregarded for years, for in 1907 Basetta writing in the Revue D'Orthopedie could only cite two cases of operation, but there were

then not less than twenty suggested ways of making plastic motors of tendons. I will not go into the details of the various methods proposed or practised, but refer you to the reports of Professor Putti's lecture in the British Medical Journal and the Lancet of June 8th, 1918, and to the articles by Vanghetti himself, by Stassen, Pellegrini and Pieri in the Archives Medicales Belges, No. 71, p. 657, of 1918.

These four articles give a good account of the whole subject. An illustrated abstract of them appeared in the Medical Supplement of the Daily Review of the Foreign Press issued by the General Staff, War Office, and on sale at H. M. Stationery Office, No. 10, of Vol. I, of October 1st, 1918. These various kinds of motors may be roughly divided into two classes, the Club and the Loop. In the former class are all those motors which are meant to be connected with the prosthesis by their peripheries while in the Loop class are all those which are connected by their inner and more central surfaces, such as the loop (in Italian Ansa, which means a jughandle), the tunnel and such like. We shall see this morning good examples of both these classes.

The Club motor consists of one or more tendons or tendinous expansions, if possible together with a portion of its bony attachment, surrounded by a sleeve of sound skin. A ring is loosely clamped round the neck of this club to which the cord or other connection with the prosthesis is attached.

In the loop type on the other hand a rod or cord is passed through a skin lined opening, in muscle or tendon or else as in the case of the jug-handle form a divided ring is clamped on to the skin covered tendon. Some of these jughandled motors consist of the tendons of the two muscles which are united together to form a loop, much as if two club motors without bone were joined together end to end.

It is asserted that besides acting together in one pull, their alternating action can be used by means of two clamps. I have great doubt of the efficacy of this arrangement, which I have not yet seen in action. Doubtless some of our members who have lately been to Italy will be able to enlighten us on this and other points.

So far as my limited experience goes, the club motor with osseous nodule in its end gives the greatest promise of usefulness.

If it is made large enough and with a large nodule of bone it is better fitted to stand the pressure of the attachment than is the tunnel and it can be so planned as to provide a large excursion or range of movement more easily than the tunnel. Also it can be placed at the end of the stump, a position more advantageous than that of the tunnel which has to be lateral.

The desiderata in a plastic motor are the following:

1. Sufficient muscular power.
2. Well nourished and innervated skin covering.
3. Ample range of movement.
4. Size—sufficient length and thickness.
5. Appropriate surface for counterpressure covered with well nourished and resistant skin.

This last condition is important. Unless a surface is available, the patient's efforts may expend themselves in simply pulling the socket of the prosthesis further on to the stump. Such counterpressure may be exerted against the end of the bone of the stump or against the sides of the wider upper part of the stump as in the forearm.

The range of movement in the upper extremity should be at least one inch, an inch and a half or two inches is preferable. If the range is small the difficulties of fitting are increased, for with a small range with loose fitting there is a danger of all the effort being expended in overcoming the back-lash. Again if the range is small only short leverage can be used and the effort must be greater.

In the case of two motors, being employed for two opposed movements, for instance, the one for extension and the other for flexion of the fingers, the range of movement in the two should be nearly the same, but a difference of range can be accommodated by varying the leverage for the two movements.

It is, I think, easier to get a good range of movement with a club than with a tunnel, because the extremity of the club is free while the distal side of a tunnel is apt to be bound down. This is specially likely if the tunnel is in tendon.

Sauerbruch, who is an enthusiastic tuneller, prefers to make it through the muscular substance. I have seen tunnels so tightly bound down, that the amount of movement was too little to be of

any use. I have, however, seen other tunnels with ample range of movement.

The amputation sites suitable for cinematisation are first, those so close to the point that the segment below the articualtion is of no use to work a socket. By re-amputating through the bone above the joint the patient's condition is no worse off, even if the cinematisation is a failure and the skin of the reamputated part is available for covering the motors, while the bones are utilized to form end nodules. Secondly stumps that are too long, after amputation through joints as at the wrist, can well afford to lose an inch or two to make plastic motors.

I think that so far most of the cases operated upon in this country fall into these two categories. But when the practical value of the procedure and particularly of the appropriate prostheses is established there will probably be few stumps that may not be improved in usefulness by the operation. There is less room for it in the lower extremity than the upper, because the functions of the leg and foot are simple compared with those of the arm and hand, and they are far more successfully imitated by existing prostheses.

In the upper extremity it seems probable that it will be best to limit the number of motors to two—extensor and flexor—a third motor designed for supination has been added, but there are difficulties in adapting prostheses for more than two motors, which, however, may be soon overcome.

When two motors are provided, say above the elbow, the question arises of how best to use them. Should one be used to move the elbow and the other to flex or extend the fingers against the opposition of a spring, or should the elbow be worked by one of the older methods, and the motors be used in antagonism to one another as flexors or extensors of the digits? Theoretically the latter method recommends itself to me, because it seems probable that with use the muscular sense may be so far developed, that a co-ordination replacing to some extent the sense of touch may be acquired. If the cinematisation hand is to acquire any delicacy of grasp it seems clear that the spring action must be avoided.

There have been few cases reported in this country. Mr. Eric Pearce Gould reported two in the British Medical Journal, p. 277, 1916. One of them, an officer, was sent to us at Roehampton to be

fitted. He had an amputation of the lower third of the upper arm and one club motor without bone nodule, connected with the flexors of the elbow.

He wore a clamp on the neck of this motor and an exercising splint with elastic resistance for nearly three months without any trouble, although the end of the club was cyanosed. Immediately after the artificial hand was fitted he left well satisfied, for South Africa, and we have not heard of him since. Major Fitzmaurice-Kelly has operated upon a number of cases, and published a paper on his experiences in the Lancet of August 16, 1919. Numerous cases have, it is said, been operated upon by other surgeons, some of whom will give us the benefit of their experiences.

Discussion.

Mr. S. Alwyn Smith (Cardiff): My experience in this method of prosthesis dates from the time when the Italian moving pictures were sent round this country showing the results of the different types of operation and their fitment with various appliances. The somewhat wonderful results had the effect of my office in the hospital being besieged the next morning by all the limbless cases who wished to undergo operation at once. My difficulty was to avoid operating indiscriminately on them all and as I am responsible in South Wales, not only for preliminary treatment, but also for the final fitting, and as I am likewise responsible for repairs, I did not feel inclined to be stampeded into doing a lot of work which might reflect upon myself in time to come.

Therefore I agreed with Sir John Lynn-Thomas that I would do a few cases on the peg motor principle. This I thought preferable to canalisation. I did not intend to do any further series of cases until I saw that the first ones had been satisfactorily fitted with arms and that the results were fully satisfactory not only surgically, but also mechanically, that is from the standpoint of work done by the limb maker. More important than all I wished to see that the cases were satisfactory industrially as this is very necessary in such a district as South Wales. It must be remembered that the majority of our cases are colliers who have earned high wages before the war in that type of skilled labour, and that they will not enter sedentary occupations as limbless cases unless they can help it. We have found by experience that they prefer to go into some kind of above-ground colliery work at which there are fairly high wages without anything which could be called intellectual strain.

I had nothing to go on at that time with regard to operative procedure, and the Putti type of artificial arms had not yet come to this country. Sir Robert Jones had a set sent him at a later date and he kindly lent them to us afterwards. I have brought them here to show you.

The first case I did on the peg motor principle was a long above elbow stump, in which I saw that even if I failed in my operation he could be satisfactorily fitted with a working arm—the amount of shortening that I should be likely to produce not being sufficient to prevent a satisfactory fitting by the old method. The method I adopted was this. I cut long antero posterior flaps of over three inches. The flaps were turned up and the main vessels and nerves were tied off above *that* (demonstration) level. The lateral points of skin where anterior and posterior flaps met had to be brought across to meet in the mid line over the end of the bone. The bone was cut through at a suitable level so that the skin could be brought across without tension. I then covered over

the end of the bone with a muscle and fat flap as I did not want the skin to adhere to the end of the bone or to slough owing to undue tension. A stitch was taken through the skin from side to side at the highest lateral points of the incision and the skin coated over the end of the bone in the middle line. This now caused each flap to become concave on its deep surface.

The brachialis anticus and biceps tendons were scraped and the former wrapped round the latter and sutured to each other. The ends were turned over during the stitching to make a hump at the end. I now carefully stitched the conjoint tendons to the deep fascia of the flap and stitched the skin edges together to cover the tendons in. I did the same thing to the triceps on the other side. When the operation was finished the suture ran in a straight line antero posteriorly up the posterior aspect of the flexor peg—across the end of the bone and down the anterior aspect of the extensor peg. On the sixth day I wrapped sterile worsted fairly tightly round the upper end of each to make a constriction and this was continued until it was substituted by the metal collar.

A serous exudate came away for about a fortnight, after which the wound finally healed and the collars were applied and constantly worn. We then started exercise against resistance by means of a light plaster of paris bucket with wire struts incorporated, the resistance being furnished by elastic bands. This served the double purpose of exercising the pegs and also extending them to prevent any tendency to recession. At the end of six weeks the man could lift ten pounds with either peg and the amount of thrust in the flexor motor was 1½ inches and ¾ inch in the extensor one. This patient has lifted seventeen pounds repeatedly with the flexor peg without pain or discomfort by the collar.

The next man I did was a forearm case. There by the same method I took the flexor carpi radialis and the flexor profundus digitorum on the one side and the two primary extensors of the wrist and the extensor communis on the other side.

In both cases the flexor peg has a larger range of movement than the extensor and this opens up a difficulty as the President has pointed out. When the flexor peg contracts it pulls on a non-elastic cord which actuates the artificial fingers through a cam or helical gear and the extensor peg is extended and vice versa. This tends to impede the efficiency of the activating peg. The problem can probably be solved mechanically.

Now we come to the tragedy of the situation as far as it affects my cases—one has been cinematised twelve months and the other eight months and neither have been finally fitted yet. One limb maker—on the approved list—tried it but the result was very cumbersome, weighty and inefficient. This man has been away home for several months—tired of waiting, and has not worn his collars regularly with the result that the zone constriction—the neck—has disappeared and we shall have to work again to get it back.

The strength of the pegs is not impaired as you will see. He had a 1½ inch thrust the last time I saw him but he cannot be fitted at present because he cannot keep the collars on the pegs securely.

I am afraid I cannot say much at present as regards the results from the mechanical standpoint. You will see Mr. Hobbs' representative here and he will fit up the arms now so that you may judge to what extent he has succeeded. I only saw the cases last Wednesday for the first time for some months—the result of the delays in fitting—but it was promised that the arms should be ready today.

There is the important question for consideration as to which is the preferable method—canalisation versus peg motors. I cannot say much on that point practically as I have done no canalisation work. The method never appealed to me as being so surgically or mechanically sound as the other.

Major Brook of Swansea has done three cases all of which came into my hands for fitting and which I show you. The same delay has occurred in these cases as in my own. One of these cases, a single canal in the biceps, has done

very well, it is very strong and has a $1\frac{1}{2}$ inch thrust. The other cases I show you have failed, partially on account of scar tissue binding down the canals. This one has only $\frac{1}{2}$ inch thrust in the flexor tunnel and barely any movement in the extensor one. So from the surgical standpoint I cannot say whether one is preferable to the other.

Ithink with the President that neither should be used in the lower extremity. The results of fitting mechanical legs is I think universally satisfactory and from what I could judge from the Italian films the cases did not walk better than ours in Cardiff. As far as the arm is concerned I am convinced that there is a future for it and I have a lot of cases down for operation if I can see that they will be satisfactorily fitted.

With regard to surgical, mechanical, and industrial efficiency, on the first will devolve as to whether peg motors are preferable to canalisation or not. The second will depend on British surgical instrument makers, which with all due deference to those on the approved list have been very disappointing to me up to the present. The work is only in the experimental stage and I do not think we are justified in doing cinematic work indiscriminately until the limb makers are educated up to the required standard, otherwise the method will fall into disrepute.

From the industrial standpoint I will show you specimens of the Putti arms that came from Italy. None of them are of any use industrially, to my way of thinking, as they are so lightly made. Here is the type for a single peg motor, working against a spring, the motor flexing the fingers against the spring resistance which at rest keeps the fingers extended and the thumb abducted. The limb makers here tell me the men will not like this type of hand and they tell me that it is better to have the hand closed and for the peg motor to extend the fingers, the spring flexing them. This, of course, is absurd. You wish the patient to re-educate his sense of touch so you must let the spring extend the fingers. If a man is going to get a better working hand by this means, it is a small matter to have an abducted thumb when the hand is at rest. These arms are too flimsily made. No arm will be of much service until it is fitted with a removable hand for walking out purposes and also a working tool, perhaps something like the American two-way clutch, which will be more or less a universal tool. Until something of this nature is evolved I do not think that cinematisation will hold any advantage over existing methods from the industrial standpoint. Here is another model with flexor and extensor pulleys, you will see to what extent the fingers can be flexed or extended onto the fixed thumb by their agency.

This model, actuated by pronation and supination movements of the stump, is, I think, a most ingenious one, and is very sound in that it makes us keep in mind how useful it is to have a long forearm stump. Also the necessity, if such a stump is available, of gaining as much active pronation and supination as possible by treatment. If you can get such a stump and get it flattened antero posteriorly so that the leather cupola does not slip on the stump, which it has a tendency to do if the stump be conical, pronation and supination movements can be made to flex and extend artificial fingers strongly and easily at will.

I asked Mr. Blatchford to make one but I was told that international complications might result should patent rights be infringed. Until this matter is adjusted probably none of the approved limb makers can make the model.

Major M. Fitzmaurice-Kelly (Brighton): Several points of very great interest have arisen already in the discussion, chiefly as to the best type of operation to carry out in these cases, also on questions connected with prosthesis.

As to the type of operation, I think one has to be guided simply by the material at one's disposal. There are certain cases to which one method is applicable, and the other is not, in which the surgeon is given no choice. But the work I have done has made me strongly of the opinion that, when you can get it, the clava type of motor is by far the best. That is so, I think, for several reasons. The first is the immunity it gives from dermatitis. In the case

of tunnels, especially if they are somewhat narrow, there is a great tendency to dermatitis. Even when they are not very narrow, dermatitis is sometimes encountered. I made one myself, in the early days, in the wrist region, and in that case the man has had eczema practically ever since. And, apart from the fact that it has not got a wide excursion, he is virtually unfittable. On the other hand, the club motors leave no crevices; and as the skin will only be subjected to intermittent pressure, it is difficult to believe that it will not harden with use, rather than become tender. Therefore I think club motors have the best chance of surviving.

But there are other, and very much more important, points. The chief of them are these: that when you get, as you have seen in some of the cases shown, a bony nodule carrying the attachment of a muscle, you there get a concentration of the whole power of that muscle at one point: whereas if you make a tunnel through it, it is hampered by adhesions, of either muscle or tendon a little way beyond, and in consequence very much less power is available. Another important point is the range. With a tunnel it is rare to get a range of more than an inch. I have seen cases, especially in the middle of the arm, where the biceps is running free over the brachialis anticus, with a much larger range than that. In most cases, however, the range is small. With a club motor, it depends on how long you make your clubs as to what range you get. Within the limits of nutrition and nerve supply there is no reason why a club should not be 2½ to 3 inches long. It is not uncommon to get, with considerable power, two inches of range.

Another question, which the President touched on, is that of fixity, with the tunnels and with the ansa motors, which are most popular in Italy, there is a tendency for the prosthesis to slide. But when you have two terminal club motors, it is the easiest thing in the world, as you have seen in one of the cases fitted up, to put a soft leather sling between the two. It comes into action the moment the motors come into play, and this prevents the sliding of the bucket on the limb.

As to the selection of cases, I do not quite agree with what Major Alwyn Smith said about our stopping and waiting for the prosthesis to be perfected. I do not think we can expect a prosthesis to be devised until we produce surgically the forces for the surgical instrument maker to apply. I think that unless we produce definite forces, unless we solve the surgical problem and present a definite engineering problem to the engineers, the latter are not likely to get work effectively. We must give them the material to work upon.

As to the sites for these operations, club motors are obviously easiest to make, where the insertions to powerful muscles are available. The earlier cases I chose were those common cases with short stump (i. e., 2½ to 3 inches) below the elbow, where the patient was unfittable in the ordinary way. The stump was too short to fix to a bucket, when flexed at a right angle. The bony nodules make excellent clubs. It seems to me you will never get the same power unless you use bone nodules: you will never avoid the strangulation which must happen when you fit a collar on to a soft tendinous mass. I noticed when one man was working with the exerciser, that one motor turned blue and the others did not. One of the motors was broad, and flat from side to side, and there was a small clearance fore and aft under the collar which allowed the circulation to be carried on. Since that time, I have made all the rings so that they did not fit accurately, but so that they took a two-sided grip on the bone nodule, leaving in that way a small clearance for the circulation. In that case one does not get interference with the circulation while the man is wearing the rings. The elbow joint cases are relatively easy, but there are very few other places in the body which offer a ready-made insertion of muscle into bone. I tried another method, of which I showed one example here, and I am disappointed that another has not come from Roehampton. These are cases of disarticulation at the wrist and elbow. In those cases I use the adventitious attachments of muscles or tendons to bone to form the bony nodules.

Now to describe the technique, which differs somewhat from that described by Major Alwyn Smith. Let us suppose that disarticulation is through the elbow. I design antero-posterior flaps, much in the way he does, and then separate the skin only from the edges, over the supra-condylar lines and edge of the bone. Coming down to the brachialis anticus, one clears it from the intermuscular septa, and then gently separates it from the bone, leaving its distal attachment where it has adhered to the end of the humerus. I cut out half the thickness of the humerus, holding the adventitious attachment of the brachialis anticus to the bone. I turn it up as an anterior club, without disturbing the skin which is adherent to the anterior surface. That helps in the fixation of the nodule. The posterior (triceps) motor is formed in a similar manner the humerus is then sawn 2½ to 3 inches higher up, and the motors clothed with skin, and two motors are produced, carrying the muscles of the upper arm.

In another case I showed, the same thing was done on the wrist. The patient has two club motors with bone nodules, and they are carrying flexor and extensor tendons which have been disturbed. Just after I had done that case, Sir Robert Jones came down to Brighton, and raised a very interesting point as to the fate of those bone nodules. Would they persist, or would they be subject to bone atrophy? We cannot give a final answer yet; that can only be done by experience. But I have had six or seven such cases, and my experience has been that, both as felt by the finger and as seen by the X-rays, the nodules of bone seem definitely to increase in size. Apparently, that depends on the fact that the periosteum is only on one side, and that the osteophytes appear to grow out into the tissues on the other side. At any rate, they form firm and large bony nodules, which I think tend to increase, rather than to diminish. So one can build club motors where the natural insertions are not available. And I think that makes possible a very important extension of the clava method

The lower end of the forearm has one handicap which is exemplified in one case I have done, namely, that the circulation is rather poor, so, in a later case, I have tried to combine the clava with the ansa method. Proceeding as before, I made my two clubs containing flexor and extensor tendons and chips of radius, and a bit of the ulna in one case. The motors were built three inches long, leaving them open at the end. I then sewed anterior skin to posterior skin, so as to form a loop, and containing two bony nodules which will serve as fixation points. I saw several of the ansa motors in Italy, but only one with a prosthesis, and it was the only case I saw with a tool and not an anthropomorphic hand fitted to it. It was a very simple form of parrot-bill forceps activated by one pulley and a spring, and the man, who was working at the lathe, did fairly well with it. It was only a simple grip, but he could hold on to small objects with it. I noticed that on the soft tissue the ring was slipping, and that there was some excorpiation of the skin from the dragging. Another point, which I raised later with the surgeon who had operated, was, that though they described this as an alternating motor, I never saw it fitted with two rings, and he admitted they did not fit two rings to it. And I do not see how it could be done without strangulating the middle portion.

As Major Alwyn Smith has said, the technical difficulty in these cases is keeping the neck to the motor, and the greatest possible care has to be taken to fix the bone in its position long enough, so that it will not escape and leave you with an empty sleeve of skin instead of a motor.

The methods I have adopted in doing it are these: I never dissect the skin flap back from the muscle which is going to form my motor if I can help it. For a posterior motor I only turn up a flap to the base of the olecranon, never disturbing the overlying skin, so as to keep it in position. Next, I fix that nodule with an anchor stitch. I have used several forms of anchor stitch. At present, I transfix the skin-edge, the tendon of the muscle, and the skin on the external side of the motor and thread a rubber tube, then transfix again, and thread on to another piece of rubber tubing, and tie it fairly loosely. That makes a mattress stitch, transfixing the whole motor, passing through the

tendon immediately above the bony nodule so that it cannot slip back, and protected where it is tied by ¾ inch of rubber tubing. I have found it safe to leave it a fortnight, and the bony nodule does not show a tendency to slip. The case which you have seen with a limb on is one of the early cases I did: he is No. 2 of the series, and the last is No. 21.

(Patient demonstrated.)

In this case I made one of the mistakes which it is easy to make. I made the motors too short. A good deal of retraction occurs in these motors, and in this instance I had to carry out a second operation. To prevent the retraction I now preserve the deep fascia and turn in a fascial flap to cover the end of the bone, thus preventing the muscles from becoming adherent to the bone, and thereby shortening the motor. In this case the whole olecranon process is in the posterior motor, and the coronoid process carrying the brachialis anticus, with the biceps muscle stitched into it, in the anterior motor. He has a very powerful pull: I have not measured what it is lately, but on the first occasion I tried it he, without straining, pulled 21 lbs. with the posterior motor, and 15 lbs. with the anterior. It is only fair to say that since that time I have removed a nerve bulb from the anterior, and I believe that now to be the stronger of the two. You have seen the apparatus he is fitted with; it is in a very incomplete state, because it is only two or three weeks since we started fitting him, and there are yet many improvements to come in.

One of the chief questions is that raised by the President: whether one should use a pure cinematic, or a mixed prosthesis, i. e., whether one should rely on the motors entirely, or reinforce them by springs. I incline to the latter view, with all due deference to the President, because thereby one can multiply the movements available. In the hand the arrangement I am having is this: the posterior motor opens the hand, and it closes with a spring. The anterior motor is used to supinate the hand, with a spring recoil for pronation. McKay has had a hand made, but not fitted, for this prothesis. The elbow is of the mechanical type. It seems an advantage to give the movements of pronation and supination as well as the power to grip an object, and I think it is worth while to sacrifice what one would gain in muscular sense so as to have the second movement.

Another point in fitting which I propose, but have not had carried out, is this. The cords from these motors, passing round pulleys in the elbow joint, are apt to hitch in flexion and to hamper the movements of the elbow joint, and also the man is apt to lose much power through friction. I propose to miss the joint altogether in these cases, and to lead the wires which are attached to the collars straight into the channels of a Bowden cable and to apply the power just above where I want it. I think I shall be able to get a much freer elbow joint, and more power at the end of the prosthesis.

This next case I want to show you as the first example of using the adventitious attachment of tendons to form the nucleus. This case was sent to me for re-amputation. He had had an amputation through the wrist, with ankylosis of the inferior radio-ulnar joint, with loss of pronation and supination. I removed about three inches of the radius and ulna, keeping the piece of the end of the radius which had the flexor tendons bound down to it in front, and keeping the piece of the back of the radius which had extensor tendons bound down to it. I thought the posterior tension stitch was pulling, and I took it out a little too soon, and consequently got a short posterior motor. With a little training, I think it will stretch down and give a sound attachment. The anterior motor gives already a sound attachment and a very good pull. The excursion is a considerable one, and should be able to activate the prosthesis very well. He has voluntary pronation and supination developed. And I wanted to show this case because of a remark which was dropped bv Major Alwyn Smith as to inequality of excursion of these motors. The excursion of one here is distinctly less than that of the other, but I do not think that will be an insuperable difficulty, because normally the movement of the extensor tendons

is less than of flexor tendons. Anyhow it seems to me easy to decentre the joint to the back, and as less strength is needed in opening the hand than in closing it, the loss of strength by increased leverage is not important. That, however, is mainly a matter for the engineer, and I do not think the requirement will be a difficult one to meet.

The most interesting question of all, I think we shall agree, is the matter of the prosthesis. And the first thing to say about that is, that it is absolutely futile to turn these cases on to the instrument makers, who are brought up in the traditions of the instrument-making trade, and ask them to make a special arm. I think the hand or tool which is supplied will have to vary with the occupation of the man, and there is no particular difficulty in doing that. I am having one case fitted up with a sort of general engineering tool, under the control of two motors. I propose to modify it in this way. At present the triceps opens the tool, and the biceps closes it. But it is asking too much of the biceps to hold on all the time while he is doing work. Therefore I propose to put in a light spring, which will close it in addition to the action of the biceps: that spring will act when holding a light object, and the biceps will reinforce it when necessary. That, I think, should make a fairly efficient tool. The man can do several things with it already, and he was only fitted yesterday; he is not one of the accomplished demonstrators who have worn an artificial limb for a number of years.

There are certain cases in which one has to use tunnels if one is to accomplish anything at all. I think we shall have to see how long these tunnels last in practice. Many patients complain of pain in them, and another serious disadvantage is, I think, the very small excursion which you get in many of them. I think most of the cases who have tunnels will be fitted for light work only, with such prosthesis as you have seen; and for a man who is a clerk and wants to hold a pen it might be useful.

I think those are the lines we want to go upon, and the power we can get out of these motors absolutely justifies us in going on with the work: and it is essential that we should go on in order to give the engineering people the material to carry out their part of the contract. If we do not go on from the surgical standpoint, we shall not get anything tangible out of them.

Mr. Blundell Bankart (London): I have only done this operation in two instances, and they were both failures; but I learned something from them, and I thought they might just as well come and be seen. In each of those two cases I think I made the elementary mistake of operating on too small a scale. I realise now that the operation must be, shall I say, massive, that we shall have to cut large flaps, and have large motors, taking out a considerable quantity of bone, so as to get them properly formed. Both of my cases were elbow cases, and I used the olecranon for the triceps, and the coronoid process for the biceps, and in each case I used a mattress fixation stitch, right through the skin from one side, through the tendon and above the nodule out through the skin on the other side. I believe—I am speaking from memory—I left the stitch in a fortnight. In each case the motor slipped up. I have no doubt that the improved technique which other people have developed has abolished that difficulty. But that is the difficulty I met with, and which reduced both my cases to failure. I have rather grave doubts as to the future of the operation. When one sees what a man who really means to can do in a workshop with a simple fixed appliance, one feels some doubt as to whether these motors are going to be used much in industrial activities. From the cosmetic point of view, I think that if an arm can be turned out with two movements, and which will be useful, it will satisfy many. But that remains to be seen.

I noticed that everybody is opposed to the operation on the lower extremity, and I have never seen a case in which it has been done. But one cannot help thinking what an excellent motor the patella would make in a flap, and one knows how difficult is the control of the knee, in an artificial leg. I think that

it will be done when people have had more experience of motor formation in the case of the upper extremity.

Major M. Fitzmaurice-Kelly (answering Mr. Bankart): I did one in the region of the knee, a double club motor, last Saturday. It has not yet been dressed. But they make mighty motors. The method I adopted was to take half the patella for the anterior motor, and for the posterior motor I chiselled off the head of the fibula with the biceps, and a portion of the head of the tibia at the insertion of the semimembranosus, grafting the two together to form a median flexor club behind. He has gone six days with a normal temperature, and seems comfortable. It seems worth doing, and the difficulties of fitting will be practically none, because one could take a bearing from the tuberosity of the ischium and give the man mechanical control of the knee, at first at any rate, to reinforce the voluntary control. The femur is sawn four inches above the knee.

The President: I have a note from Sir John Lynn-Thomas, who has had to go back to Wales. He was called back unexpectedly last night, so he regrets he is not able to fulfil his engagement to come here.

Mr. Rowley Bristow: I would like to offer one or two remarks on these points. In company with Major Dunn I visited Italy three or four weeks ago, we were able to see what they are doing there. We went to one clinic and saw the surgeon in charge, and he kindly showed us his records and such cases as he had got. He had done the operation 70 times. We asked him what his end-results were, and he said he had never seen a limb fitted, nor the subject to which one was fitted using it. And that—and it is my first point—is, I think, the danger we are faced with. If surgeons all over the country are "let loose on stumps" to cinematize them with tunnels or with motors, and they do not see the end-results of the fitting, they cannot know where they are wrong, nor where they are right. I think it is important that all these cases should be segregated in some limb-fitting centre, or orthopaedic hospital, where they will be in immediate touch with limb-fitting centres. I do not think these operations should be recommended by this Association, at the present time at any rate, as suitable for general use. That is the criticism which we all brought back very strongly from Italy. When we went out, we were told that two distinguished surgeons who had visited them had no use for the operation in any form. That seems to me to be going to the other extreme. From what Major Fitzmaurice-Kelly has shown us, and from what we saw in Rome and Bologna it seems that the only salvation for a man with an arm stump is some reasonable form of cinematic amputation. But cinematisation cannot be a success unless the surgeon and mechanician work together in one institution. At Bologna Putti has 200 beds and 100 men working in his shops. He is seeing them every day, and if the head mechanician has any alteration to suggest, surgeon and mechanical expert consult together. No elaborate arrangements are necessary in order to get hold of the patients; they are there on the spot. I do not think this problem, which we are discussing, will meet with a satisfactory solution until something of the same sort is done here.

With regard to leg stumps, we saw one leg stump which had been cinematised in a boy aged 15, whose leg had been amputated for a tuberculous knee. A skin tunnel had been made in quadriceps and it did not look as if it was very useful, or would prove to be so in the future. I think it is very important at the present time, that the essentials of the business should be thoroughly grasped rather than that we should start away, now, in the present stage, and attempt to cinematise and make prostheses for legs as well. Everybody here seems to regard this problem of artificial legs as easy, finished and done with. I go to the War Seal Foundation, where they have 70 discharged soldiers. I saw three of them this week, and none of the three was wearing his artificial limb. It is well known that artificial arms are hung up behind the door and not used, I think the same can be said of many artificial legs too. In other words, I do not think we ought to feel self-satisfied about the condition of artificial limbs gen-

erally. With regard to the types of motors, those which Major Fitzmaurice-Kelly showed us today are superior to anything I saw abroad. But there may be a use for the loop motor or the tunnel, particularly in the neighborhood of the shoulder joint, using the pectorals and the muscles at the back of the scapula. It seems as if, by means of a motor, something might be done for those cases of disarticulation at the shoulder joint.

Another matter is the prosthesis itself. Major Alwyn Smith, who showed limbs from Italy, said they were toys, and useless. The limb which we saw in Putti's clinic was extraordinarily good. These limbs were very light, they had skeleton buckets, made of thin steel, coated or vulcanised with rubber, and they weighed very little. And in considering the prosthesis there is the question of what the terminal organ should be. Is it going to be something representing the complicated human hand, or should it be something simple? Captain Maxwell favours something representing a hand, and he showed us one which gave promise of achieving that result. I think it important that, at the commencement at any rate, the prothesis should be made as simple as possible. I see no reason why the limb he showed us, which was carrying a long forearm, should not be shortened by one-half, thus bringing the end organ much nearer the motor, and giving better control. Instead of aiming at a complicated apparatus, which will give three or four movements, I think the first thing to do, and as soon as possible, is to have a mechanic working in association with the surgeon to turn out something simple with which the man can work.

Editorial

SELECTIONS FROM THE ANNUAL REPORT OF THE ORTHOPAEDIC DEPARTMENT, MASSACHUSETTS GENERAL HOSPITAL.

January 1, 1919, to January 1, 1920.

The Department of Orthopaedic Surgery at the Massachusetts General Hospital shared with the other Departments a severe handicap to its efficient functioning in the first half of 1919 owing to the members of its staff who were in the service of the U. S. Army.

The chief of the service, the visiting Orthopaedic Surgeon, and two of the assistant visiting surgeons, enlisted early and were discharged late. It was extremely difficult to obtain assistants in the Clinic or House Officers of ability. The very highest praise should be given to the members of the Department who carried on its activities in addition to the onerous burdens of teaching in the Orthopaedic courses given in connection with training of many surgeons who enrolled in the section of Military Orthopaedic Surgery in the U. S. Army. The Department wishes to express its thanks to Dr. C. F. Painter whose temporary appointment on the staff was of great value.

Social Service.

The value of the Social Service work as an integral part of the Clinic has been again amply demonstrated. One of its most important functions is a sympathetic discussion with each patient referred to the house, of his or her resources and the probable length of time during which he will be cut off from wage earning.

At the present time, a follow up system (temporarily suspended during the war) is being re-installed with the help of this department.

In October, Col. E. G. Brackett, for many years the Chief of the Clinic, resigned. Dr. R. B. Osgood has been appointed in his place. The loss of Dr. Brackett's services is a very heavy one for

this Clinic and for the whole Hospital. His able conduct of the Service inspired the loyalty of every member of the Department. He possessed the personal affection of all his Staff. He has been appointed on the Consulting Staff of the Hospital and it is hoped that after his return he will still continue to be actively interested in Departmental and General Hospital matters.

ORTHOPAEDIC SURGEON AND CHIEF OF SERVICE.

Dr. Robert B. Osgood, continuous service.

ASSISTANT VISITING ORTHOPAEDIC SURGEONS.

Dr. Mark H. Rogers, continuous service.
Dr. Zabdiel B. Adams, continuous service.
Dr. C. Herman Bucholz, continuous service.

ORTHOPAEDIC SURGEONS TO OUT-PATIENTS.

Dr. Murray S. Danforth, continuous service every other day.
Dr. Harry C. Low, continuous service every other day.
Dr. Lloyd T. Brown, continuous service every other day.
Dr. Louis A. O. Goddu, continuous service every other day.
Dr. Marius N. Smith-Peterson, continuous service every other day.
Dr. Loring T. Swaim, continuous service every other day.
Dr. Andrew P. Cornwall, continuous service every other day.
Dr. Philip D. Wilson, continuous service every other day.

ASSISTANTS TO ORTHOPAEDIC SURGEONS TO OUT-PATIENTS.

Dr. L. P. Felch, continuous service every other day.
Dr. W. J. LaMarche, continuous service every other day.

HOUSE OFFICERS.

Dr. Jackson, House.
Dr. Spiers, House and Out-Patient Department.
Dr. Surls, House and Out-Patient Department.

Special Assignments and Clinics are as follows:
Poliomyelitis Clinic—Dr. Low.
Scoliosis Clinic—Dr. Bucholz.
Posture Clinic—Dr. Brown and Dr. Swaim.
Club Foot Clinic—Dr. Z. B. Adams and Dr. Brown.

Congenital Deformities—Dr. Z. B. Adams.

Unusual Back Lesions with Referred Pain—Dr. Danforth.

Peroneal Spasm—Dr. Goddu.

Internal Derangements of Joints and Tuberculosis of Knee—Dr. Osgood.

STUDIES OF END RESULTS.

End Results of Bone Graft Operations—Dr. L. T. Brown.

End Results of Arthrodesis of Hip for Non-Tuberculous Arthritis—Dr. Rogers and Dr. Spiers.

End Results of Operation for Excision of the Knee—Dr. R. B. Osgood.

End Results of Operation for Knock-knee and Bow Legs by Epiphyseal Separation—Dr. Z. B. Adams and Dr. H. C. Low.

End Results of Stabilizing Operation on the Feet, Infantile—Dr. W. L. Adams.

End Results of Hallux Valgus Operation—Dr. Spiers.

End Results of Operation for Internal Derangements of Joints, Cartilages and Osteochondritis Dessicans—Dr. R. B. Osgood and Dr. Surls.

End Results of Congenital Dislocation of Hip—Dr. Z. B. Adams.

Treatment and Results in Scoliosis—Dr. C. H. Bucholz.

End Results of Osteotomies for Correction of Bow Legs and Knock-knees—Dr. L. P. Felch.

RESEARCH.

Dr. M. S. Danforth—The Anatomic Explanation of Referred Symptoms in Low Back Lesions.

Dr. L. A. O. Goddu—The Etiology and Treatment of Peroneal Spasm of the Foot.

Dr. L. T. Brown—The Technique and End Results of the Exogenous Bone Grafts.

Dr. M. N. Smith-Peterson—Approaches to Joints.

Dr. Z. B. Adams—The Reduction and After Treatment of Congenital Dislocations of the Hip.

Dr. Mark Rogers—The Operative Treatment of Old Tuberculosis of the Hip in Adults.

Dr. R. B. Osgood—The Operative Treatment of Tuberculosis of the Knee in Adults.

Dr. H. C. Low—The End Results of Fixation Treatment of Tuberculosis of the Hip in Adults and Children.

Further Subjects for Research.

1. Confirmation of Brooks' and Allison's silver nitrate fascia in arthroplasty.
2. Cinematic Amputations.
3. Experimental Osteochondritis Dessicans.
4. Experimental Legg-Calve-Perthe's disease.
5. Effect of motion on fractures under traction.
6. Effect of motion on Tuberculosis of joints.

ANNUAL MEETING BRITISH ORTHOPAEDIC ASSOCIATION

Held in the Rooms of the Medical Society of London, on
Friday, November 14th, 1919.

MR. E. MUIRHEAD LITTLE, F. R. C. S.,
President, in the Chair.

EXECUTIVE PROCEEDINGS.

The Treasurer's report was received and adopted.

Candidates for election.

The President: There are two candidates for election. Mr. S. T. Irwin, of Belfast, and Mr. R. Ollerenshaw, of Manchester. Both have submitted theses, which have been read by the Nomination Committee and approved, and their names are now before you for election.

Carried unanimously.

Election of Honorary Member.

The President: It is proposed to elect as an Honorary Member, Professor Arthur Keith. You all know his work, and he has done very much by that work to popularise orthopaedic surgery. He is a distinguished anatomist, and the Nomination Committee thought his election would do honour to this Society.

Carried unanimously.

Election of Corresponding Member.

The President: There is also down for election as a Corresponding member, Dr. Murk Jansen, of Leyden. He is very well known to us all, and I think he is a very charming personality. He is a very ingenious writer on anatomical and orthopaedic subjects.

Carried unanimously.

Election of officers, 1920-1.

The President: We now come to the important business, the election of officers for the next year. You have the list of nominations before you. As

President, Sir Robert Jones; as Vice-President, Mr. Tubby; as Treasurer, Mr. Bennett; our present Honorary Treasurer; and as Secretary, Mr. Harry Platt, our present Secretary. I do not think I really need say anything about any of these gentlemen. Sir Robert Jones is, of course *facile princeps* in this domain, and ought to have been President before, in my opinion. Mr. Tubby also has done a great deal for orthopaedic surgery. The work of the Honorary Treasurer and the Honorary Secretary are well known too. Is it your pleasure that I put these names *en bloc?*

Carried unanimously.

Communication from Mr. Girdlestone.

Mr. G. R. Girdlestone: Sir, the communication I have to make concerns this paper, "The Care of Crippled Children," which, I think, you all have, which has been published in "The British Medical Journal." The paper was written by Sir Robert and myself because we felt there was no proper organization of orthopaedic treatment. In some places there are hospitals, in some there are none. One felt that hospitals ought to be instituted all over the country for the cure of cripples of all sorts. It was published in the "British Medical Journal" rather than being brought before this Association, firstly, because time was pressing, and next, it was felt to be vitally important that all the medical practitioners of the country should become aware of what ought to be done and what could be done for these cases. It is the universal experience, of all orthopaedic surgeons that they get cases coming within their province a greal deal too late. It is equally their experience that, having treated a case, it is exceedingly difficult to manage after-care. Those were the two points in regard to which we particularly appealed in this paper. Taking an established hospital in Shropshire as a guide, we have analysed the cases which have been attending that hospital, and these are typical of those requiring orthopaedic treatment. We have endeavoured to show what is the class of case we must endeavour to cater for. These require orthopaedic measures, and almost all of them are cases which need prolonged treatment, and treatment in the open air. Further, they demand educational facilities, and, if possible, some sort of handicraft or some sort of manual training which will enable them to re-start in life with greater capacity than they would have otherwise. Some of the children only come in for a short time, it is true, but some of the cases have to remain in for two or three years, and some of them must almost inevitably remain crippled. We felt, therefore, the need of education and some handicraft instruction added to orthopaedic measures in an open air country hospital. And it was clear that the general hospitals could not provide the needed treatment. They have not got the beds available for these cases, nor the country hospitals, nor the educational facilities; all of which are necessary. Therefore this communication was published in the "British Medical Journal" so that the country might realise—that is, the general practitioners might realise—the type of cases we are hoping to treat, and the way in which we are hoping to treat them. And one felt that the second step was to bring this to the notice of the British Orthopaedic Association, as its members are essential for the success of such a scheme. In planning the paper, we felt that some Central London Committee was necessary, so as to co-ordinate the activities of the various orthopaedic hospitals everywhere throughout the country. In order to obtain governmental authority,

it would have to be associated with the Ministry of Health, and, in order to obtain the best results from clinical organization the British Orthopaedic Association should be well represented upon it.

I have brought this paper to your notice today in the hope that when Sir Robert Jones comes back, a sub-committee may be formed to approach the Ministry of Health, with the view of this work being commenced. The opportunity ought not to be lost, because we have these Pensioner Orthopaedic hospitals all over the country, and if we act now, it will be easy to develop the Pensioner Orthopaedic hospitals into the hospitals of the kind we advocate. The Pensions Ministry is organising "Regions," and is attaching to orthopaedic hospitals out-patient clinics, which will be inspected and brought into touch with the central hospital. That is the scheme we have outlined, and it will be perfectly easy, if we can persuade the Ministry of Health to co-ordinate their activities with those of the Ministry of Pensions to make the central hospital the same, the out-patient clinics the same. And as the need for pensioner work grows less, so the need for children's work can be supplied and be made to fit in. Therefore one feels that now is the time to take action. I do not know whether we should do anything now, or wait until Sir Robert Jones returns.

The President: I think we all agree with the plan of Mr. Girdlestone. And I think the better plan will be for him to propose a resolution on the subject, affirming the need of a sub-committee, and that it be formed after the return of Sir Robert Jones.

Mr. Girdlestone: I propose that the President be authorised to form a sub-committee in association with Sir Robert Jones on his return, for the purpose I have outlined.

Mr. Fairbank: I second that.

Carried.

MEDICAL VETERANS OF THE WORLD WAR.

Col. Frederick F. Russell, M. C., U. S. Army, secretary of the Medical Veterans of the World War, states that during February, 169 new members joined, making a total membership of 2,711 divided as follows:

Medical Corps, U. S. Army	1,245
Medical Corps, U. S. Navy	51
Medical Corps, U. S. P. H. S.	62
Contract Surgeons, U. S. Army	88
Acting Assistant Surgeons, U. S. P. H. S.	47
Members Local Board	527
Members Examiner, Local Board	183
Members Medical Advisory Board	508

—*Journal A. M. A.*

EXPERT EVIDENCE—FRACTURE CASES.

In a cross-action for malpractice, the exclusion of a question asked a physician on cross-examination, intended to show that there was no bony union in the fracture which a doctor had rebroken was held error; the question being calculated to test the competency of the witness and discredit his statement on direct examination that he had found such osseous callus. Whether a physician called as an expert witness be permitted to illustrate his testimony by means of a human skeleton is held a matter left to the sound discretion of the court, but where its use could not have aided the jury, denial of permission was not abuse of discretion. It is held that only an expert could properly determine and testify as to the nature of the treatment and required amount of force that might be exercised to break adhesions in fractured bones, but a requested instruction, implying that only an expert could testify as to the amount of force that was actually used was properly refused.—Dameron v. Ansbro, (Cal.) 178 Pac. 874.—*Medical Record.*

FREE DIAGNOSTIC CLINIC FOR BUFFALO.

The Board of Managers, Department of Hospitals and Dispensaries, of Buffalo, N. Y., announces the inauguration of a free diagnostic clinic for the use of physicians of Buffalo and Erie County. The clinic is for diagnosis only and is designed primarily for the use of physicians' pay patients who cannot afford the customary consultation fee. No treatment will be given. A report of the findings in each case, signed by the examiner, will be mailed to the physician sending the patient. The members of the diagnostic staff are chiefs of divisions on the attending staff of the Buffalo City Hospital and also hold professorships in the medical college. Dr. W. W. Plummer is assigned as consultant in Orthopaedic Surgery.

Dr. Hinman K. DeGroat, medical superintendent of the Department of Hospitals and Dispensaries, will be in charge of examinations.—*New York Medical Journal,* February 28.

Announcement

ANNOUNCEMENT 1920 ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION.

To the Editor of the Journal of Orthopaedic Surgery:

It is felt by the President that the following information will be of interest to the members of the Association:

The next meeting of the Association will be held in Toronto, Canada, on June 7, 8, 9 and 10, 1920. Monday, the 7th of June, will be a Clinical day and preparations are well under way to make this a most enjoyable and profitable day. It is hoped as many members and guests as possible may plan to be present to take advantage of the opportunities of seeing the work of the Canadian Hospitals, both military and civilian. The three following days will be occupied with the regular program of the Association, and the Program Committee is already at work and a most attractive program is planned.

We had hoped to have the British Association meeting with us in joint session, but on account of war conditions the Secretary of the British Association states it will be impossible to accept our invitation.

We have, however, individual acceptances of our invitation by a number of continental surgeons, and we are delighted to be able to state that Sir Robert Jones will be present, together with a number of other men from the British Isles who have rendered distinguished service during the war. Among these are Major Naughton Dunn of Birmingham, Major T. H. Armour of Liverpool, Major Rowley Bristow of London, and others. Professor Jacques Calve, of Berck Plage, France, has also promised to be present and contribute to our program.

Professor Putti, of the Rizzoli Institute, Bologna, Italy, has also consented to visit us and will make an interesting contribution.

Toronto is a noted convention city and should be at her best in June.

Will not all the members make a personal effort to be present that the Association may go "over the top" in an effort to reach our objective, namely, the greatest meeting in the history of the Association.

CLARENCE L. STARR, *President.*

Dr. G. W. Sinclair of Vancouver, B. C., has telegraphed that the Orthopaedic Section of the C. M. A. will meet in Vancouver, June 22-25. It as been arranged that papers will be presented among others by the following: Drs. Gibney, Galloway, Abbott Albee, A. McCausland, Patterson and Orr.

The Central States Orthopedic Club will meet for a day at Memphis as part of the trip to the A. M. A. meeting in New Orleans. Dr. J. P. Lord, of Omaha, is President and Dr. F. W. Gaenslen is Secretary. The meeting will be on April 26.

Personal

Dr. Eben W. Fiske has announced the re-opening of his offices for the practice of Orthopedic Surgery at 6079 Jenkins Arcade, Pittsburgh, Pa.

Dr. Jay Harvey Bacon announces his return to civil practice. During the last four months Dr. Bacon was head of the department of Orthopedic Surgery in the Base Hospital at Camp Hancock, Ga. He is at 800 Peoria Life Building, Peoria, Ill.

Town Topics of February 5th contains a short but generous appreciation of Dr. Newton M. Shaffer of New York. Dr. Shaffer's notable activities in connection with the development of Orthopaedic Surgery in this country are related and various personal and professional data of importance recorded.

Dr. J. D. Griffith was one of the guests at a recent dinner in Kansas City in honor of those who had completed fifty years of practice. Dr. Griffith is just 70. He came to Kansas City at the beginning of his professional career in 1870. Born in Jackson, Miss., Feb. 12, 1850, he completed his medical course in the University of New York at the age of 20. Dr. Griffith has enjoyed not only the respect and confidence of his patients and associates, but their affection as well. This was admirably shown by the spirit which animated his friends at the dinner. Dr. Clarence B. Francisco introduced Dr. Griffith with an eloquent testimonial to his professional achievements and his own personal regard. Dr. Griffith has always had a commanding professional position in Kansas City, having been for 46 years chief surgeon and now chief of staff of St. Joseph's Hospital, a handsome institution of 350 beds. At the office the Doctor is surrounded by books and pictures to show to how many friends and places his acquaintance and influence extend. Dr. Griffith is still an active and enthusiastic practitioner.

Orthopaedic Titles in Current Literature

Prepared by Dr. J. E. M. Thomson, Lincoln, Nebraska.

Albee, F. H., New York—Studies in Bone Growth; An Experimental Attempt to Produce Pseud-arthrosis. A. J. of Med. Sciences, Philadelphia. January, 1920, 159, No. 1, p. 40. Restoration of Loss of Bone Including an Analysis of the First Hundred Cases of Fractures Treated by Bone Graft at U. S. Army General Hospital No. 3, Colonia, N. J. Weigel, M. D., Assistant. Journal of A. M. February 28, 1920, 74, No. 9, p. 589.

Alessandri, B. The Technique and Preferential Sites for Cinematization of Amputation Stumps. Clin. Chir., 1919, XXVI, p. 565.

Angeletti, E. Deformity of Shoulder Resembling Coxa Vara. Chirurgia degli Organi di Movimento, Bologna, December, 1919, 3, No. 5-7, p. 513.

Arana, G. Bosch—Cinematic Prosthetics. Semina Medr., 1919, XXVI, p. 191.

Arci and Ivanissevich—Spring Finger from Tendon Trauma. Semina Med., 1919, XXVI, p. 107.

Arey, L. A.—Origin, Growth and Fate of Osteoclasts and Their Relation to Bone Resorption. American J. of Anatomy, Philadelphia, January 15, 1920; 26, No. 3, p. 315.

Asam—Splint for Fractured Radius Munchener Medizinische Wochenschrift, Munich, November 7, 1919, 66, No. 45, p. 1293.

Auvray—The End Results of Operations Upon 39 Radial Nerve Wounds Performed 1915 and 1916. Bull. et. mem. Soc. de Chir. de Par, 1919, XLV, p. 1291.

Batensweig, J.—Treatment of Fractures of Femur. New York Medical Journal, 1919, CX, p. 722.

Barron, N., and Bainbridge, W. S.—The Barron Ladder in the Treatment of Flat-Foot. International Journal Surgery, 1919, XXXII, p. 341.

Bellin, Alvin, and Vernet—Tuberculous Lesions in Temporal Bone. Journal de Chirurgie, Paris, December, 1919, 15, No. 5, p. 486.

Boeckel, I.—The Treatment of Radial Paralyses by Tendon Anastomoses. Presse Med. Par., 1919; XXVII; p. 624.
Almost Total Functional Restoration After Operation. Lyon Med., 1919. CXXXIII, 455.

Boorstein, Samuel, W., New York—Postdiphtheritic Paralysis with Report of Two Cases. Journal American Medical Association, February 21, 1920, Vol. 74, No. 8, p. 512.

Bolognesi, G.—Collateral Circulation in the Limbs. Chirurgia degli Organi di Movimento, Bologna. December, 1919, 3; No. 5-7, p. 413.

Bompiani, R.—Critical Review of Treatment of Compound Fractures from War Wounds. Policlinico, Rome. October, 1919, 26, Surg. Sect. No. 10, p. 336. Conc'n.

Bradford, E. H.—Ambulatory Treatment of Fracture of the Neck of the Femur. New York Medical Journal, 1919, CX, p. 835.

Brandes, M. and Meyer, C.—Nerve Shifting and Joint Adjustment in Relation to Primary Nerve Suturing. Munchener Medizinische Wochenschrift, Munich. October 31, 1919, 66, No. 44, p. 1256.

Braun, O.—Emergency Treatment of War Fractures. Deutsche Zeitschrift fur Chirurgie, Leipzig. March, 1919, 149, No. 1-2, p. 100.

Buckley, J. P.—Case of Dislocation of Cervical Spine. Lancet, London, January 17, 1920, 1, No. 5029, p. 149.

Buerki, R. C., Boise, Idaho.—Splints Used for Peripheral Nerve Cases at U. S. Army General Hospital, No. 11. Archives of Neurology and Psychiatry, February, 1920, 3, No. 3, p. 151.

Byfield, A. H., Iowa City—Etiology of Arthritis Deformans in Children. American Journal of Diseases of Children, February, 1920, 19, No. 2, p. 87.

Caccia, F.—Treatment of War Wounds of Joints. Chirurgia di Movimento, Bologna, December, 1919, 3, No. 5-6, p. 562.

Calve, J.—Tuberculosis of the Spine. Presse Medical, Paris, January 7, 1920, 28, No. 2, p. 13.

Cameron, U.—A Case of Bilateral Osteoplastic Resection by the Wladiniroff Micpulicz Method. Chir. d. Organi di Movimento, 1919, III, p. 401.

Campbell, W. C.—Fibula Transference for Tibial Defect. Journal Orthopaedic Surgery, 1919, XVII, p. 625.
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Cautley, E.—Poliomyelitis, Report of Cases. British Journal of Children's Diseases, October-December, 1919, 16, No. 190-192; p. 193.

Celesia, A. F.—Treatment of Fractured Leg. Prensa Medica Argentina, November 30, 1919, 6, No. 18, p. 181.

Cesarano, U.—Tuberculous Process in Hip Joints and Congenital Luxation. Chirurgia degli Organi di Movimento, Bologna, December, 1919, 3, No. 5-6,, p. 549.

Chalier, A.—Purulent Gonococcic Arthritis Treated by Arthrotomyand Mobilization. Lyon Med., 1919, CXXVIII, 400.

Chalier and Vergnory.—Gunshot Fracture of the Lower Third of the Thigh, Fistula, Etc., Cavity Filled with Muscle, Recovery. Lyon Med., 1919, CXXVIII; p. 401.

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Delbet, P. and C. Girode.—Loss of Substance of the Radius Prosthetics of Reinforced Rubber. Bull. et mem. Soc. de Par., 1919, Xiv, p. 1327.

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Engel—Rickets in Germany: Study of Effects of War on Children. Lancet, London, January 24, 1920, p. 1, No. 5030, p. 188.

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Current Orthopaedic Literature

A ROENTGENOLOGIC STUDY OF METASTATIC MALIGNANCY OF THE BONES. A. B. Moore, M. D. *American Journal of Roentgenology*, 1919, Vol. VI, No. 12, p. 589.

Pfahler in 1916 directed attention to the characteristic roentgen appearance of metastatic carcinoma of bone and the necessity of thorough X-ray examination of known and suspected cases of malignancy, and the author further emphasizes the necessity in a summary of 65 such cases seen at the Mayo Clinic.

Froenken, von Recklenhousen and others describe two types of secondary bone metastasis—the osteoclastic and osteoplastic.

The osteoclastic is characterized by lacunar absorption and destruction of bone, causing a porosis of osseous tissue. While the osteoplastic also has lacunar absorption, there is a marked thickening of the bone due to the collection of malignant cells and the calcification of the process. Some observers find the two types occurring simultaneously in the same bone.

Roentgenologically, the osteoclastic form appears as decreased density, the bone having a honeycombed aspect; while the osteoplastic appears irregularly increased in density, being chalky without cortical or periosteal thickening.

The osteoclastic occurs more often as secondary to breast malignancy, the osteoplastic more often from carcinoma of the prostate.

Authorities disagree as to the course of extension, whether by blood stream or lymphatics.

Contrary to the findings of Mathews in the author's series, metastases from primary thyroid carcinoma are relatively rare. Of the series, the primary growth was:

Breast	36 Cases	Sigmoid	1 Case
Prostate	11 Cases	Uterus	1 Case
Kidney	7 Cases	Abdominal mass of unknown nature	3 Cases
Thyroid	2 Cases	Primary source unknown	3 Cases
Vulva	1 Case		

In 1,600 cases of cancer of the stomach no secondary bone involvement was found—probably due to the rapid and fatal course of the process. Of the seven kidney tumors, six were hypernephromas and one a so-called neurocytoma, a tumor originating in the sympathetic nerves of the adrenal, this being the case of a 13-year-old boy with skull and sternal metastases. Of this series, the metastasis was distributed as follows:

Spine	22 Cases	Sternum	1 Case
Pelvis	11 Cases	Radius	3 Cases
Femur	9 Cases	Skull	3 Cases
Ribs	6 Cases	Tibia	2 Cases
Humerus	6 Cases	Bones of the hand	1 Case
Clavical	1 Case		

This series does not coincide with Risley, who states that metastasis is rare below the elbow and knee. In the 22 cases of vertebral involvement, 75 per cent were located in the lumbar region.

Th clinical histories show that the average age of these cases was 50 years, 42 being females and 23 males. The time of appearance of secondaries after the discovery of primary growth was 2½ years.

The most common symptom is pain, noted in 57 per cent, resembling a neuritis, increased by motion. Superficial swelling is uncommon, while irregularities may be noted on palpation. Spontaneous fractures occurred in six of the 65 cases. In two there was no previous indication of malignancy. In but three of the cases was there any evidence of lung involvement.—*J. E. M. Thomson, Lincoln, Nebraska.*

Dislocation of Innominate Bone. John T. Murphy. *American Journal of Roetgenology*, 1919, Vol. VI. No. 12, p. 601.

According to Stimpsen, a review of the literature reveals but 15 authentic cases of dislocation of the innominate bone, of which two were complicated by fracture.

The author's case is that of a six-year-old boy who fell from the seat of a heavily loaded wagon and the abdomen was passed over by the front wheel. Shock was marked and patient could not be moved for ten days, when the leg was flexed and foot everted. Hematoma covered the entire lumbar region. X-ray revealed a backward and upward dislocation of the entire bone without fracture, with evident tearing of anterior and posterior interosseus ligaments of sacroiliac joints, and also ligament of symphysis pubis.

Attempted reduction under anesthesia failed. Fixation in plaster cast for three weeks brought normal function.—*J. E. M. Thomson, Lincoln, Nebraska.*

Myxoma of Bone, with Report of Case of Myxochondro-Sarcoma of the Femur. A. Cotton and S. McCleary. *American Journal of Roentgenology*, 1919, Vol. VI, No. 12, p. 594.

The authors recall a case of myxoma of the femur previously reported in 1917, which was amputated at the hip joint and which developed secondaries in the lower abdomen more than two years after operation. Death occurred without pathological examination of tumor mass.

The second case was that of a man 45 years of age with a medullary tumor of the femur which was diagnosed as myxochondroma, and which, after chiseling and curetting, healed only to recur and require amputation at hip joint when diagnosis of myxochondro-sarcoma was made, with alternate metastasis in lungs and stump.

It is the authors' opinion that they were dealing with multiple chrondromata primarily, which underwent myxomatous change with subsequent sarcomatous development.—*J. E. M. Thomson, Lincoln, Nebraska.*

COCCYGODYNIA. FURTHER EXPERIENCE WITH INJECTIONS OF ALCOHOL IN ITS TREATMENT. By Frank C. Yeomans, M. D., F. A. C. S., New York. *Surg., Gynec., and Obst.*, Vol. XXIX, December, 1919, No. 6.

1. Neuralgic theory that trauma caused violent nerve irritation which persists without any demonstrable anatomical nerve lesions.

2. Neuritis from pressure of the foetal head on the terminals of the sacral plexus.

3. Theory of injury of the cocoyx, resulting in fracture, dislocation, ankylosis, or caries.

4. Symptomatic, i. e., a referred pain of central origin due to many functional or organic diseases of the central nervous system, as hysteria, neurasthenia, irritable spine. the traumatic neuroses, tabes dorsalis, toxaemia, or "habit pain."

A history of traumatism within the pelvis, as in difficult labor or external violence, most commonly a fall, is so often responsible for the condition that searching inquiry must be made in every case. Rarely there is a gross lesion of the coccyx but as a rule the injury affects the periosteum alone and the soft structures adjacent or attached to the bone,—muscles, fascia, ligaments and nerves.

The nerves composing the coccygeal plexus are the fourth and fifth sacral, the coccygeus and the inferior haemorrhoidal branch of the internal pudic. There are also on the anterior surface of the coccyx two ganglia of the sympathetic, connected to each other by fine nerve filaments to the last sacral ganglion of the chain which constitutes the pelvic sympathetic.

The coccyx is surrounded by compact structures, largely fibrous, which the delicate network of nerves traverses. Injury of these structures initiates an inflammatory reaction with proliferation and later contraction of the new fibrous tissue and compression of the nerves. Fracture or dislocation of the coccyx may cause pressure pain.

Symptoms.—The chief symptom is a characteristic, spasmodic aching pain, usually localized in the region of the coccyx, aggravated by sitting or rising, and seldom affected by urination or defecation, though constipation is usually present.

Diagnosis made by a thorough examination, both general and local. The former embraces the spinal column to discover injury or disease and the nervous system to exclude tabes dorsalis, hysteria, the neuroses, etc.

The local examination is made with the patient in the Sims' posture.

Lesions of the anal canal and rectum, simulating coccygodynia, are to be excluded.

In general the prognosis is good.

Excision of the coccyx is a simple operation but should be reserved for those cases in which it is diseased or deformed or after the injection treatment has failed. The fact that in some cases the pain persists after the removal of a clinically normal coccyx and is relieved in others, indicates that in those which were relieved the nerves were excised together with the bone.

The treatment is an application of the principle of injecting sensory nerves with 70 to 80 per cent alcohol, thereby causing their degeneration.

Technic.—The injections are made easily at the office under strict aseptic precautions. The patient assumes the Sims' posture and the region of the coccyx is painted with tincture of iodine. An aseptic syringe of 2 cubic centimeters' capacity is filled with 80 per cent alcohol and armed with a 2-inch needle of fine gauge. With the index finger in the rectum, the point of maximum tenderness is determined by counter-pressure with the thumb outside. Usually this is just distal to the tip of the coccyx or slightly lateral to it. Maintaining the finger in the rectum as a guide, and to guard against its puncture, the needle is inserted through the skin in the mid-line directly to the tender point. When this is reached the patient may exclaim from exquisite but tolerable pain and 10 to 20 minims are injected slowly. The needle is withdrawn quickly and the iodine on the skin is neutralized with alcohol. The pain from the injected alcohol lasts only a few minutes but a dull ache may persist for 24 hours. A single injection has cured a few cases but generally owing to the broad distribution of the coccygeal plexus of nerves, one to ten treatments with an average of three or four have been necessary. The interval between injections should be from five to seven days and the solution is always deposited at the point found most tender at the time of injection.—*Leo C. Donnelly, Detroit.*

SYMPOSIUM ON CLOSED TRAUMATIC LESION OF THE WRIST. Albert Mouchet. *Revue de Chirurgie*, May-June, 1919.

After discussion of the anatomy the speaker reports on experimental studies made on 90 wrist specimens in order to establish the mechanism of the traumatic lesion. These lesions are produced either by hyper extension without impact or with impact or fall in hyperextension, by simple palmar flexion or by torsion in pro and supination. The fracture of the lower extremity of the radius, fracture of the lower extremity of the ulna, radiocarpal dislocation and traumatic lesions of the wrist are discussed.

Regarding fracture of the lower extremity of the radius it has been pointed out that function should never be sacrificed to alignment or form and that successful reduction is of comparitively little value if not followed by speedy mobilization.

Two types of traumatism of the wrist are deserving of special mention; the fracture of the scaphoid and the dislocation of the os magnum, or rather, as Mauchet calls it, the sub-total retro-lunar dislocation of the wrist. These two lesions are frequently associated.

Aside from this there exist fractures of the semi-lunar bone and fractures of the os magnum; they are more frequent than is generally believed.

Increase of the antero-posterior diameter of the wrist, and a sort of bayonet deformity, but situated more peripherally, suggests dislocation of the os magnum, especially if there is also a shortening of the wrist with claw hand, or at least, weakness in the flexors of the fingers.

A localized swelling in the circumference of the wrist speaks in favor of fracture of the scaphoid.

Regarding the semi-lunar bone, one should remember that it can be explored from the volar side where it should be found immediately above the

lower palmar fold of the wrist. The scaphoid can also be explored from in front over the radial artery and above the root of the thenar, between tendon of the flexor carpi radalis and the long abductors of the thumb. Dorsally, it can be palpated in the tabatiere and underneath the tendon of the extensor pollicis longus.

The integrity of the relations between the tips of the styloid processes of the radius and the ulna will eliminate radio-ulnar lesions and points to the carpus as the seat of lesion. The motion of the fingers in fracture of the scaphoid is usually unimpaired. Where the flexion power of the fingers is greatly diminished dislocation of the os magnum should be suspected. Pain in the distribution of the median and ulnar nerves especially the median, are also very frequent in the latter condition. X-ray pictures should always be taken in two directions. The reading of the X-ray plates is not always easy and errors in interpretation often occur in injuries of the carpus.

The dislocation of the os magnum must be reduced speedily in order to become possible, at all. After one month has passed it should never be attempted. It is then necessary to remove the semi-lunar bone and in cases of accompanying ing fracture of the scaphoid resection also the fragments of the latter bone which is attached to the semi-lunar.

An isolated fracture of the scaphoid will be benefited by operation in cases of malunion or persisting painfulness.

Savarioud (Paris) observed two cases of dislocation of the semi-lunar bone. One case has been treated by massage for two months. The pain was very marked and fingers immovable. Enucleation of the semi lunar bone gave relief.

In the other case there was recent dislocation of this bone accompanied by lesion of the scaphoid and neighboring bones. Reduction under chloroform was carried out, but dislocation recurred three weeks later. Then the semi-lunar was removed together with the bone fragments in the neighborhood. Following this the pain disappeared.

Billet reports on a very peculiar case of dislocation of the carpus due to a railroad accident. The hand was forced into right angles with the forearm. This injury, which was an open one, was treated by resection of the wrist. Concerning dislocation of the semi-lunar bone, Billet is of the opinion that bloodless reduction is preferable to operative intervention. In one case of complete dislocation of the semi-lunar with fracture of the scaphoid and of the styloid process of the radius he obtained reduction and rapid permanent recovery. On the other hand, in another very simple case reduction was found impossible on the second day and an operation had be performed.

Judet (Paris) mentions three cases. In the first case there existed an epiphyseal separation of the left radius in a patient 15 years old, the injury following a fall. The reduction was obtained by dorsal flexion. The result was excellent. The second case observed concerned a case of recurrent carpal dislocation, a wrist a ressort. Immobilization was necessary for three months and was followed by recovery.

The third case was a very rare combination of fracture of the radius with dislocation forward of the ulna, a combination which is very difficult to handle. Following reduction and immoblization a good result was obtained.

Willems has studied the method of active moblization in injuries of the

wrist. He finds that its application is in the larger joints and is also recommendable. He points out that in order to avoid persistent palmar flexion, immoblization should be carried out in dorsi flexion, and even if ankylosis occurs in will be most favorable to function.

Potherat (Paris) finds the semi-lunar dislocation to be a well known feature. It occurs frequently in time of peace, especially among horse-men and automobilists, and he asks why it is found comparatively seldom in war surgery. This is doubtless due to the fact that the lighter cases of this kind were neglected and the more severe cases were immediately evacuated. The dislocation of the semi-lunar is more frequent than would appear from the reports. It is also easy to diagnose. Regarding the treatment, recent cases should be reduced under anesthesia, in older cases operative procedure is indicated.

One should keep in mind that reduction is possible after a longer period of time than usually mentioned.

Potherat was able to accomplish reduction six weeks and even two months after the accident.

Berard (Lyon). In regard to dislocations of the semi-lunar the speaker believes also in a longer possibility of reduction although the time is variable and depending upon anatomical conditions. If reduction is not possible removal of the semi-lunar bone is indicated. Wherever fracture of the lower end of the radius co-exists, immobilization is necessary in all cases.

Froelich (Nancy) believes that bloody reduction of the semi lunar should not be rejected. He reports a case with good result.

Paschoud (Lausanne). Based upon the study of 14 cases of closed lesion of the semi-lunar bone, from his own observation and 10 from the service of Quervain, points out that dorsal flexion and radial abduction is the position of choice for production of the dislocation of the semi-lunar bone. In this position the triangular ligament offers the least resistance and the radio ulnar joint is relaxed. If the os magnum forms the key to the carpus the semilunar might be compared with the bolt.

Masini (Marseille) contributes one observation of forward dislocation of the semi-lunar bone caused by fall upon the back of the flexed wrist. This case was easily reduced under general anesthesia and recovered completely in 20 days.

Tedenat (Montpellier) has seen three cases of backward displacement of the wrist complicated by evulsion of the styloid process of the radius or ulna.

Rocher (Bordeaux) presents seven observations of fracture of which four concern the scaphoid; one the scaphoid and styloid process of the radius, one was an epiphyseal separation of the radius and one a dorsal dislocation of the trapezium.

The latter was produced by fall upon the palm and necessitated for reduction, removal of the scaphoid and lengthening of the retracted tendon of the index and third finger.

Lance (Paris) mentions a case of fracture of the semi-lunar bone by direct blow. This case showed marked limitation in the movements of the wrist. The fractured semi-lunar was removed by the posterior route. The patient recovered in 20 days.

Chilbet (Aurillac) found twice an isolated forward displacement of the tip

of the ulna, a very rare occurrence. Reduction was made in either case by forcible pronation.

Peraire (Paris) points out to the advisability of using the stereo-radiograms. Such carpal lesions as were mentioned by the speaker were taken for syphilis or tuberculosis or were sometimes regarded as rheumatoid or gonorrheal. He contributes a number of cases of his own observation; two cases of simple fracture of the scaphoid; one of fracture of the scaphoid with fracture of the lower end of the radius; one fracture of the triquetrum; two simple dislocation of the scaphoid without fracture; one of incomplete dislocation of the scaphoid with fracture of the base of the first metacarpal; one dislocation of the scaphoid with fracture of the first and second metacarpal; one complete dislocation of the scaphoid with fracture of that bone; and finally one observation of dislocation of the bases of the fourth and fifth metacarpal.—*A. Steindler, Iowa City, Ia.*

AMPUTATION STUMP IN RELATION TO FITTING ARTIFICIAL LIMBS. E. J. Rose, M. D., Capt. M. C., U. S. Army, Gallipolis, Ohio.

An ideal amputation should be of such a length as to enable the artificial limb makers to fit the most useful type of limb built to perform as nearly as possible the function of the absent member. The stump should be covered by skin and subcutaneous tissue just slack over the end and freely movable. There should be no redundant skin or pointed corners. There should be a firm non-adherent scar or cicatrix, the scar should be linear and placed where it will not be subjected to pressure or irritation by the artificial limb. The edges of the skin about the scar should not be turned in. The stump must be entirely free from pain or tenderness. The principal nerves should be cut as short as possible at the primary amputation. There should be no superficial or deep edema. There should be shrinkage and consolidation of all parts of the stump. The joint next above the amputation should possess full range of voluntary movement. The integument must become so hardened as to be able to bear subsequent pressure and especially is this true of stumps of the lower extremity whose duty is primarily that of a support, and secondarily acting as a lever for moving the apparatus.

The importance of preserving as much as possible of the thumb or even of one finger can scarcely be insisted upon too emphatically. A thumb or even part of a thumb, or finger with fair range of motion and nerve supply though there be no portion of the hand to which it can be opposed, is very much more useful than an artificial contrivance. Amputation at the wrist should never be done if it is at all possible to retain any portion of the hand or carpus. Amputation through the pronator quadratus is preferable to a disarticulation of the wrist.

From the prosthetic point of view the best site for amputation in the forearm is at the junction of the middle and lower thirds. If an appliance is not to be worn, as long a stump as possible should be preserved. The minimum forearm stump measured from the tip of the olecranon process is 3 inches. A forearm stump less than this ceases to exist as a stump anteriorly when

flexed. When it is possible to retain only such a short portion of the bone, the flexor muscles of the wrist and fingers, the supinator longus and the extensors carpi radialis longior and brevior should be removed at their humeral attachments so as to leave the anterior surface of the forearm stump as flat as possible. Amputation through the elbow joint offers no advantage over amputation immediately above it, since in the former case the satisfactory fitting of an artificial arm is more difficult.

The point best suited for amputation in the upper arm is about one inch above the condyles of the humerus. Above this point it is particularly desirable to secure as long a stump as possible. A short arm may be lengthened by dividing a portion of the pectoralis major and teres minor tendons and thus raise the anterior axillary fold. It seems advisable to retain any portion of the upper end of the humerus, even if only the head, rather than remove it since the appliance is fitted much more easily when the glenoid cavity is filled.

CONCLUSIONS.

1. The amputation stump should have a satisfactory length, a good mobile covering, a firm nonadherent cicatrix so placed as not to be subjected to pressure or irritation by the artificial limb, a freedom from pain and tenderness, and absence from edema, a shrinkage and consolidation of all parts of the stump, and a free normal mobility of the joints above.

2. The surgeon should have clearly in mind the sites of amputation best suited for the fitting of an artificial appliance.

3. The surgeon should have a knowledge of the artificial limb maker's requirements of a stump and also a knowledge of the fundamental points of the artificial limb maker's art.

4. Experience has proved the value and wisdom of using provisional appliances in the early treatment of men with amputations, and it is hoped that there will be a universal acceptance, by surgeons, of this as the approved method of treatment.

5. However perfect a prosthetic appliance may be, it must be remembered that it will never reproduce the anatomic and physiological characteristics of the amputated limb, and will never actually replace the lost member, but observation of many cases shows that faithful and intelligent practice, under guidance, will add immeasurably to the effectiveness of the artificial limb.—*Leo C. Donnelly, Detroit.*

THE TREATMENT OF BONE CAVITIES. By Walton Martin, M. D., Surgeon to St. Luke's Hospital, New York. *Annals of Surgery*, Vol. LXXI, January, 1920, No. 1.

It has long been recognized that cavities and tunnels in bone, when opening on the surface of the body, heal slowly or not at all.

Such cavities result from opening circumscribed pyogenic abscesses in long bones from removal of local tuberculous foci, from curetting away new growths, from excision of bone cysts and in chronic haematogenous osteomyelitis. In in-

fected compound fractures, especially gunshot fractures, very complicated cavities and tunnels result. The external or subperiosteal callus encloses one or more detached necrotic fragments or sequestra, and this casing of new bone is analogous to the involucrum of chronic haematogenous osteomyelitis.

Healing can only occur if, beneath the granulating surface, new bone or new connective tissue is formed, and thus the level of granulations is gradually raised until the cavity is filled up and the skin heals over the surface.

The most satisfactory method of dealing with a cavity with rigid walls is the removal of such portions of the bony wall as will permit the soft parts to come in contact easily with the remaining under-lying bone; the replacement of an unyielding wall by a yielding wall. This means usually the conversion of the cavity into an outer gutter. It presupposes complete removal of all foci of osteitis and every morsel of necrotic tissue or sequestrum. It means, in many instances, a most formidable and extensive operation.

In bone cavities in close proximity to a joint, the removal of the roof and side walls, with the idea of allowing the soft parts to fall in, may be almost impossible or necessitate a very difficult flap or plastic operation with damage to sound tissue. In certain tunnels following compound fractures, the removal of all the bone on one side of the tunnel leaves the shaft very weak and with poor mechanical support.

In treating infected bone cavities the following conclusions may be drawn:

1. That complete removal of all the infected bone lining the cavity, of all foreign bodies and of every particle of dead bone is essential.
2. That in the great majority of cases the cavity must be obliterated to insure healing.
3. That this is most satisfactorily accomplished by the removal of sufficient portions of the wall of the cavity to allow the soft parts to fall in and fill it up.
4. That in certain tunnels and cavities near joints some form of plugging may be indicated.
5. That of the many materials used as plugs the free fat transplants present real advantages.
6. That the two-stage operation, with careful sterilization of the cavity under bacteriological control, following the Carrel-Dakin technic, is of great value.
7. That in the small chronic bone abscesses in the ends of long bones with attenuated infection no filling or intermediate sterilization is necessary.—*Leo C. Donnelly, Detroit.*

BRACHIAL BIRTH PALSY: A PSEUDOPARALYSIS OF SHOULDER JOINT ORIGIN. By T. Turner Thomas, M. D. *American Journal of the Medical Sciences*, February, 1920.

Thomas is satisfied that 4 cases of brachial birth palsy as well as 18 adult cases following injury have been pseudopalsies due to inclusion of the brachial nerves in an axillary inflammation, consequent upon an injured shoulder joint and not true paralysis from injuries of the brachial plexus. It is a pseudoparalysis in the sense that it is only temporary in the great majority of cases. Up to within a year the theory was that these (obstetrical) cases were due to a stretching or tearing of some of the roots of the brachial plexus due to for-

cible separation of the head and shoulders during labor. Delbet and Cauchoix collected 33 cases and added two of their own of brachial paralysis in adults following dislocation of the shoulder in which the nerves were exposed at autopsy or operation, usually in the axilla. No rupture was found but the nerves were imbedded in circatricial tissue, inflammatory tissue or bloody extravasation. Lange found the same in one case. In 81 cases Wyeth and Sharp found that the "usual lesion was a dense connection tissue formation choking the plexus and thus impairing its function." Most others who have operated upon the plexus in obstetrical paralysis have interpreted these cicatrical conditions as being due to rupture of the brachial plexus. Probably the only case on record with autopsy soon after birth showing evidence of injury is that of Danyan who did not find nerve rupture but bloody extravasation around the plexus. He regarded it as evidence of injury of the plexus by forceps, and most of the writers who have since quoted the case agreed with him.

Seeligmuller thought that the bloody extravasation came from injury of the surrounding tissues by forceps. He believed with Fritsch who found bloody extravasation under the skin and in muscles in autopsies of children born by the breech that such blood could alone cause paralysis by pressure on nerves and that with the disappearance of the blood the paralysis would disappear. Fritsch cites one case of head delivery with haematoma near the lower end of the sternomastoid and paralysis of the corresponding arm which cleared up with the disappearance of the haematoma. In 1872 Duchenne in four infants localized the paralysis by electrical reaction in every case to the deltoid, biceps, brachialis-anticus and infra-spinatus. In 1874 in four adults Erb localized the paralysis by electrical reaction to the deltoid, brachialis anticus and biceps, usually to the supinator-longus and sometimes supinator brevis, in one case to the supply of median in the forearm and hand. (C V and C V 1 Duchenne-Erb Theory). This theory has been accepted without question by Sever and others. But very little evidence exists corroborating the original investigations of Erb and Duchenne. Sever's methylene blue injections into the capsule of the shoulder joint seem to prove that we do have the kind of paralysis which he found soon after birth and do not have the Duchenne Erb type, that is a paralysis of the whole arm at and below the shoulder joint but in no way affecting the nerves above the clavicle—no typical V and IV C paralysis. Kortweg on "The Results of Dislocation of the Shoulder and Its After Treatment," reviewed 845 cases. He says: "For the diagnosis of a nerve paralysis the author demands the presence of disturbances of sensation and the complete or partial reaction of degeneration." Thomas infers that "nerve paralysis" applies here to paralysis due to nerve Injury and that Kortweg must have found some that were not in that class. He adds that Kortweg's diagnostic rule will some day be applied to the obstetrical paralyses by the profession generally and that the Duchenne-Erb theory will fail to stand the test. The theory of a shoulder origin with involvement of nerves occurring secondarily has gained rapidly In the last few years and has had occasional support from the beginning.

Experiments on the cadaver show that exceptional force is required for the production of a tear of the plexus by traction and it is likely that sufficient traction on the head at birth to rupture the brachial plexus has never been applied In a successful delivery.

Treatment—Practically all surgeons interested in the condition have adopted the shoulder joint treatment, although the acceptance of the shoulder origin has not been so general. The shoulder joint is injured at birth or it is not. If it is that is the time to correct the damage. If there is no displacement complete recovery will probably follow sooner or later without special treatment. If a displacement goes several weeks the chances are that operation will have to be resorted to. If it goes a year the chances are that the normal relation of the joint cannot be restored. Sever says that mere division of the subscapularis tendon is followed by reduction of the dislocation but Thomas is inclined to agree with G. G. Davis in that the good results of the operation are "due not to replacement of the head of the humerus but to the free division of the restraining tissues and placing the parts in better position." In all of Thomas' cases the shoulder deformity in obstetrical paralysis has always been the same and has three important characteristics: internal rotation of the head of the humerus, mild posterior displacement and bending downward over the head of the acromion antero-externally. It is this bent acromion in front of the humeral head that accounts for the permanence of such a mild subluxation, i. e., permits the head to rest on the posterior glenoid margin without slipping into the cavity. In all probability no case with a dislocation of the shoulder has ever recovered a normal arm although with shoulder treatment they have been very much improved, depending upon the degree of improvement in the shoulder joint.—*E. E. Hobby, Iowa City, Ia.*

Studies of the Toxicity of Bruised Muscle Tissue Relative to the Etiology of Shock. Delbet. Revue de Chirurgie, May-June, 1919.

Starting from the idea that phenomena of shock are due to absorption of tissue devitalized by traumatism the author has used experimental injections of muscle pulp into animals who had experienced no other trauma.

As material for injections cubes of horse meat were used, rendered aseptic by immersion in tincture of iodine and later, in order to improve asepsis, muscle tissue was taken from small animals which were totally immersed in chloric acid during 15 minutes, the muscle tissue being obtained by most painstaking aseptic technic.

In addition the muscle pulp was examined microscopically before the injection was carried out.

All injections were made into the peritoneum. The number of experiments amounted to 213 injections made on rabbits, dogs, guinea pigs, cats and rats. The author thinks it probable that the muscle pulp shows different qualities according to whether derived from muscles in state of rest or in a state of fatigue, also whether the animal was starving or well fed.

The toxic manifestations following absorption of muscle substance were found as follows:

The first cardinal symptom was that of dyspnoea. This sometimes reaches 150 respirations a minute. After a short period of increased reflex irritability reflexes disappear and the animal finally becomes torpid and comatose. From

this the author concludes that absorption of muscle tissue from bruised muscle tissue following gun-shot wound is capable of producing this symptom of shock. This symptom of dyspnoea and coma are undoubtedly manifestations of intoxication of the nervous system. On the clinical side of the predominance of nervous symptoms has been pointed out and upon the strength of this experiment the old theory of the nervous pathogenesis of shock was founded. Contrasting with this is the newer theory of the toxic nature of shock.

Death occurs under two different conditions. Sometimes the animals succumb without rallying from coma; others will regain consciousness, rally and succumb from 8 to 36 hours afterward.

The instances of early death are those in which intoxication of the nervous system exists. Where death is retarded, however, general toxic symptoms are present, especially changes in the liver cells and suprarenals. One important fact is that animals that escape death from nervous intoxication are not at all safe from succumbing finally to the toxic manifestations of the liver and suprarenals.

The changes in the liver are progressive and are found more advanced in cases that die later.

Histological examination of the liver shows degeneration and atrophy of the liver cells and appearance of chromophiles. Degenerative symptoms start first in the center of the lobules and spread toward the periphery.

The toxicity of the liver substance itself was proven by injections in a series of animals.

By comparing the effects of muscle injections from one species to another the author also established conditions of homo or hetero toxicity. The author concludes that the symptoms of shock which above all seem to be due to a state of nervous depression, there is a factor active on the order of anaphylaxis created by penetrating of certain albumines into the organism. In this way, it may be explained, that shock symptoms are frequent and severe in war wounds. He also makes a distinction according to previous state of nutrition in that previous protein nourishment will render individuals much more susceptible to this anaphylactic symptom of shock. For this reason he also believes that the rural population with more vegetarian diet will prove more resistant to shock following crushing wounds than the city population which depends more upon protein diet. From this consideration the author draws certain practical conclusions as regards post operative diet. He emphasizes the importance of vegetable diet both immediately before and after the operation.—*Arthur Steindler, Iowa City, Ia.*

THE USES OF FREE TRANSPLANTS OF THE FASCIA LATA IN SURGERY. G. Gray Turner. *B. M. J.*, January, 17, 1920.

The author uses free transplants of the fascia lata for protecting sutured nerves or tendons where there is loss or extensive damage to the superficial tissue. The advantages are that it prevents sloughing, inhibits sepsis, and promotes the rapid growth of granulations.

Further, he advocates the use of a portion of fascia rolled as a cigarette and sutured between the ends of tendons to replace the loss of these structures. Fine catgut is used as suture material, the ends of the tendon being always inserted into the roll of fascia.

Further uses of the fascia lata transplant are to cover exposed brain and for repair of the urethra.—*Dr. Thomson.*

KNEE JOINTS. H. Winnett Orr. *Nebraska State Medical Journal*, February, 1920, Vol. 2, p. 33.

There are two groups of knee joint injuries—internal derangements and compound injuries. The former are often infective, and may be acutely suppurative; the latter are generally acutely suppurative. The treatment implies three principle agents—surgical operation, splint, and plaster of paris. All other treatment is secondary to these and should not be relied upon too much, but should be used only in association with the principal agents. Of these are mentioned heat, light, massage, electricity, etc. Many knee joint conditions need immobilization only, as in some cases of ruptured crucial ligaments.

General Sir Robert Jones has shown the possibilities, simplicity and relief brought by removal of loose portions of cartilage of external or internal semilunars.

In suppurative processes of the knee joint associated with fracture of lower end of femur or upper end of tibia, immobilization with adequate drainage is an essential.

Relative to the recent discussion concerning the treatment of infected knee joints with motion to prevent ankylosis, these cases may be classified as to original condition and as to treatment advisable into four groups. First, acute suppurative without compound injury or fracture. After adequate drainage these may be treated in some cases with motion throughout.

The second group constitutes cases of compound injury, stab or bullet wounds without extensive damage to articular surfaces. They may be often closed and heal primarily; however, should suppuration occur thorough drainage and the Willems method may be instituted.

In the third group, where compound injury is complicated by fracture of femur or tibia, adequate drainage and perfect immobilization must be used. Ankylosis is to be expected, and should be in knee flexion of 20 to 25 degrees. In certain of these cases amputation is necessary.

The fourth group constitutes cases from the three other groups which have run a long suppurative course with pus pocketing up the femur and thigh and down the leg with general septicemia. Some of these extremities are saved by radical drainage and proper immobilization in Thomas splint and plaster of Paris. Amputation, when necessary, is followed by improvement resulting from good drainage and a period of rest.

For the Willems method of mobilization of the knee in those cases which were formerly permitted to ankylose, both the patient and the surgeon should be carefully selected.—*J. E. M. Thomson, Lincoln.*

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HABITUAL DISLOCATION OF THE SHOULDER JOINT

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Submitted to the British Orthopaedic Association, Nov. 1919

Habitual dislocation of the shoulder joint is a comparatively rare condition but cases are continually presenting themselves and in my own work, during the past year, I have met with four instances.

All of these have been given treatment of a conservative nature before I saw them but one of them had been operated upon. All four were young men engaged in active work and one of them was an epileptic.

Patient No. 1 was a very well developed man of 26 years, by trade a collier, but also a professional rugby footballer, whose left shoulder had first been dislocated in 1917 as a result of a "tackle" at football. The dislocation was reduced and his arm restrained in its range of movement for a month. The dislocation did not recur until 2 months later. From that time until I saw him in December, 1918, the joint had been dislocated on ten occasions.

The second case was that of an army pensioner, aged 27, whose right shoulder was first dislocated by a fall in 1912. Since that time the dislocation had recurred on 29 occasions.

The third patient, aged 28 years, had been subject to epileptic seizures since his 21st year and in June, 1918, his left shoulder became dislocated during an attack. He is accustomed to have about

one attack each month and the shoulder has dislocated with every attack since it first happened, eighteen times in all. The man complained little of his epilepsy as he had a light and safe occupation, but found the fixation of the arm and the necessarily restricted movement allowed after each dislocation to be a serious disability.

When admitted to hospital for operation this man arrived with the shoulder dislocated, having had an attack on the previous evening. The joint was radiographed before and after reduction.

The fourth case was a well developed man of 30 years who first had a dislocation of the right shoulder as a result of a fall from a ladder in 1915. Twelve months later during sleep the dislocation recurred and since that time he has had thirteen dislocations, the last being ten days before admission to hospital.

All these men were obviously in need of radical treatment.

The operative treatment of the condition has resolved itself into three methods. I purposely omit from serious consideration such operations as excision of the head of the humerus, gouging out the glenoid fossa and arthrodesis of the joint as being quite unjustifiable as primary measures in the treatment of this condition and based on a wrong idea of its pathology. The three remaining methods are:

1. Pleating the capsule.

2. Exsection of a portion of the antero-inferior aspect of the capsule and narrowing it by overlapping the edges.

3. The deltoid flap operation.

The first method has been followed, in some reported cases, by a permanent cure and on many other occasions by a recurrence. The second method, excision of a portion of the capsule, has been practised fairly extensively and it was strongly advocated by T. Turner Thomas of Philadelphia in 1914. This surgeon had operated upon 18 shoulders in sixteen patients and eleven of these had obtained good useful joints without recurrence after very adequate tests. Five cases, however, were followed by recurrence, some of them after two or more capsule operations. This method was adopted in the first of my four cases and has been followed so far by a perfectly stable joint although it is now nearly a year since it was performed and the man has worked as a collier since April, 1919.

In my opinion the muscle flap operation offers the best means of overcoming the tendency to dislocation because it provides, firstly, a good sling bracing up the head and neck of the humerus and, secondly, a muscular sling which contracts when the rest of the deltoid is in action, that is to say, in abduction of the arm, in which position the dislocation occurs. In 1909 Clairmont described a method of utilising a strip of deltoid in this way and reported two cases. Briefly the operation consists of two stages: the first is performed through an anterior incision splitting the deltoid and, by dividing the pectoralis major insertion downwards and separating the heads of the biceps, exposing the so-called quadrilateral space from the front. The space is opened up and enlarged downwards by dividing the upper edge of the tendons of insertion of latissimus dorsi and teres major downwards for three-quarters of an inch. The anterior circumflex artery is seen in the upper part of the wound and marks the upper limit of the operative field.

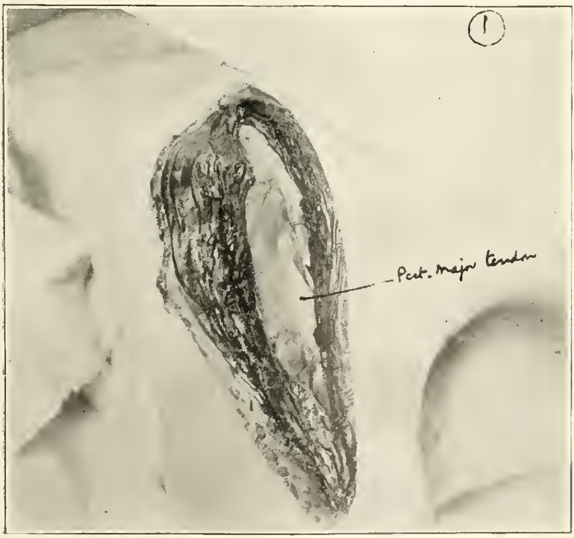

FIG. 1.

The patient is now turned on his side and the second stage takes place through an incision running parallel to the posterior edge of the deltoid and about one and one-half inches in front of this line. The deltoid is exposed and split along the line of the skin incision right down to its insertion and upwards as far as the point where the branches from the circumflex nerve enter its deep surface along with branches of the posterior circumflex artery. With this flap now turned well back the circumflex nerve and artery can be seen crossing in the upper part of the wound (Photograph No. 3). The origin of the outer triceps head is now exposed and its uppermost fibres separated downwards. This clears the space from behind so that there is now a channel for the passage of the flap. A long forceps is now passed through from the anterior wound and the point of the flap seized and drawn through. (Photograph No. 4.) According to Clairmont the flap is now to be sewn to the edges of the split deltoid in front, in the upper angle of the wound. The pectoralis tendon is repaired and the wounds closed.

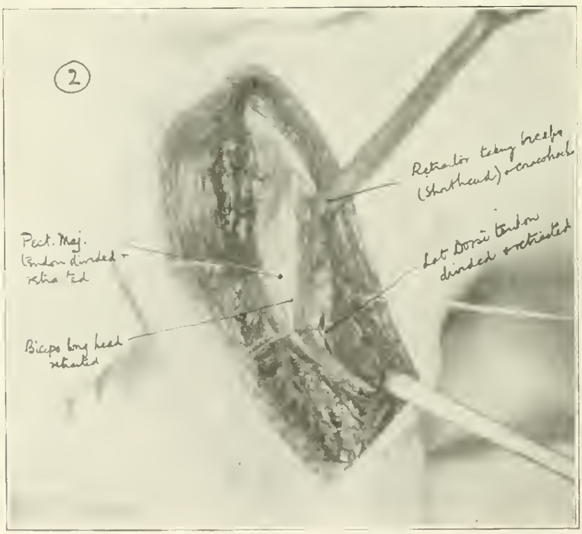

FIG. 2.

From my experience of the performance of the operation in the three cases now reported there are two points which require particular attention. The first one is with regard to the length of the deltoid flap. This must be as long as possible and, to ensure this, the muscle must be divided not merely as far as its tendon but right down to its periosteal insertion so that it may be sufficiently long to come well round the joint with no tension. The second point refers to the position to which the apex of the flap is to be sewn after being brought to the front. The suturing to the sides of the split deltoid as described by Clairmont, does not allow the flap to lie in such close apposition to the capsule as does fixation to the anterior surface of the subscapularis tendon. (Photograph No. 5.) This latter position also gives it a firmer attachment. The active slinging up of the joint when the deltoid flap

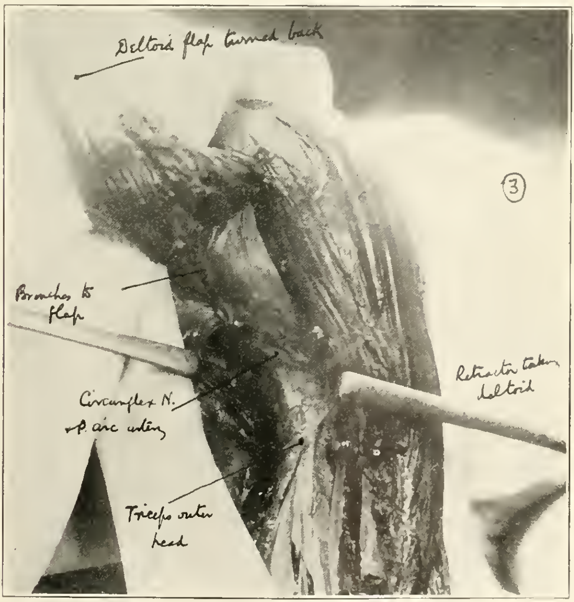

FIG. 3.

contracts can be well demonstrated at operation by direct faradic stimulation of the muscle after the suturing is completed. It is easy to estimate in this way the value of the transplanted strip of muscle. So far as I know this method has been tried very little in this country or in America.

Mr. Armour read a paper before the Liverpool Medical Society in 1914 in which he described two cases at which he had assisted Sir Robert Jones to perform the operation. The first of these operations failed as the dislocation recurred a few months later and the failure was considered by Sir Robert and Mr. Armour to be due to two factors—firstly, tension on the muscle flap and, secondly, too early active movement of the joint. It was considered that the flap had been too short and had torn away from its attachment and in this way its support had been lost.

The second case, an able seaman, whose shoulder had been dislocated 28 times, resumed his work four months after operation

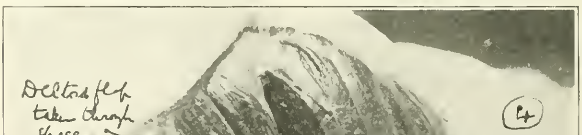

FIG. 4.

and has had no recurrence since. I know that both Sir Robert Jones and Mr. Armour have performed the operation since that time and I believe they have found it successful.

I have not allowed any of my cases to take the arm further than sixty degrees from the side until one month after operation and have then allowed gradual increases of active movement until at the end of two months there was a full range. With the epileptic I thought it wise to restrain his arm so that abduction beyond sixty degrees was impossible for two months after operation. All the patients expressed the opinion that the joint had a feeling of being braced which gave them confidence in using it. With regard to the pathology of the condition several of the cases reported by Thomas revealed at operation bony injuries of varying extent ranging from a detachment of a small fragment of joint margin to the separation of the anterior half of the glenoid, but Thomas regarded

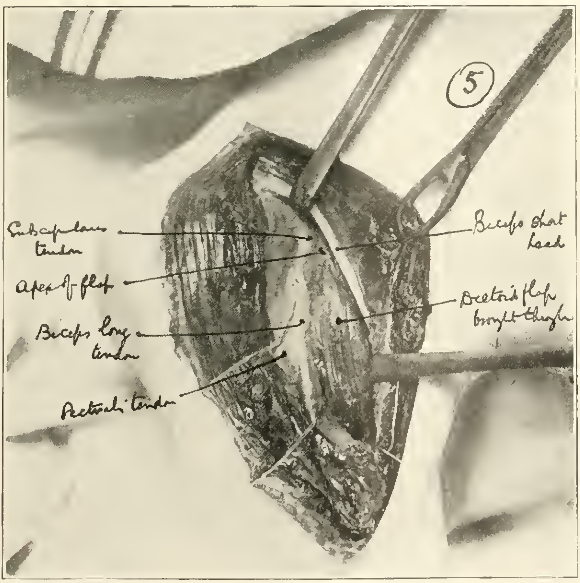

FIG. 5.

the recurrence of dislocation as being due to an enlargement of the joint capsule comparable to a hernia and spoke of the condition as a "hernia of the joint."

I am only able to state that in none of my cases was any bony change demonstrable by radiogram or at operation in either humerus or scapula.

Possibly small cartilage injuries, too small to be demonstrated without opening up the joint, may have been present but a careful palpation of the glenoid rim in each case showed no gross change in contour. In all of my four cases the capsule appeared to be lax but not markedly so in any of them.

In the fourth case there was a considerable prolongation of the synovial lining of the joint along the long biceps tendon, reaching down nearly as far as the upper edge of the pectoralis major tendon.

This distended process was, in its upper part, as thick as an adult little finger and tapered off as it descended; it bulged into the wound and was dissected off the tendon, transfixed in its upper part and tied off like the sac of a hernia.

I am of opinion that the recurrence of the dislocation is primarily due to a loss of muscular balance in the muscles controlling the joint, associated with a certain amount of capsule laxity, and that the most reasonable way of dealing with it is by providing an active muscular support which will come into action, and restore the muscular balance, in those positions of the joint in which the dislocation usually occurs. This method also has the additional advantage that it does not require opening up of the joint cavity.

Thomas found so much discharge of blood and synovial fluid after some of his operations that he advocated drainage as a routine measure after capsulorraphy. With our present technique these are no doubt small drawbacks to an operation but they are none the less loopholes through which trouble may occasionally arise.

It has been noted that several surgeons have, in the past, written papers dealing with this difficult subject, most of them referring to a single case and the further fact that none of these writers have contributed a second paper on the subject, giving their later views or reporting the condition of their cases at a subsequent date, has also been commented upon. All of my cases were operated upon

during the past year and so far there has been no recurrence in any of them, but I fully recognise that I am not yet entitled to refer to them as permanent successes. I intend to deal with any further cases by the muscle flap operation and at some future date I propose to report upon all such cases, including those referred to in this paper.

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Discussion.

The President: I think you will agree with me, gentlemen, that this is a very excellent thesis, and we can congratulate Mr. Ollerenshaw on his technique, and so far as time has allowed for these to be seen, the results of his operation It is a condition which is very disabling and distressing, and is well worth the comparatively severe procedure planned for its cure.

The subject is now open for discussion.

Major Dunn (Birmingham): I have had the opportunity of seeing a good many of the operations for recurring dislocation of the shoulder. In my experience excision of a portion of the capsule or plication of it has not infrequently been followed by recurrence. In one case I remember in which this operation had failed—Clarimont's operation gave a good result. One case of recurrent dislocation of the shoulder on which I did a Clarimont's operation 15 months ago recovered complete free movement of the joint and was discharged 3 months later. The man was a farm laborer and promised to let me know if he had further trouble. I have not heard from him since.

Mr. S. Alwyn Smith (Cardiff): The last remark strikes me as bearing out the results of plication cases. I understood that if the results were good it was because the motion in abduction was limited and that if the movement was not limited to less than 60 degrees recurrence took place. Before I went out to France I had a case on which I was about to operate. I intended to supplement plication of the capsule by an operation to limit abduction at the shoulder joint beyond 60 degrees. This I intended to do by means of a strip of fascia lata extending from a hole drilled in the upper portion of the humerus, just below the circumflex nerve, to another hole drilled in the axillary border of the scapula. This fascial loop would effectively prevent abduction beyond the zone of safety. However, the war came on and the patient went to France where he was unfortunately killed in action in 1915. He was a well known ice hockey player and in one season he dislocated his shoulder on several occasions.

If the sling operation proves successful it should be better than limiting the abduction movement of the shoulder joint.

Mr. Bristow (London): I have a case at Shepherd's Bush at present who is also an epileptic, and he has dislocated his right shoulder 18 times, and his left 16. I performed this operation on his right shoulder six months ago, and since that time he has had several fits and dislocated the left shoulder four times, but the right has not since gone out. It is of course far too early days to claim this as a success, but it is encouraging. Since then I have operated on the left shoulder as well. One point is, that by this operation you do not do

the man any harm. I did not have any trouble about it and he worked out his own salvation. I let him abduct in three weeks, and the right arm is as good as the other. There is no need to have the patient first on his back, then on his side. If you have the patient lying on his side with a sandbag under the scapula, you can keep him in the same position all through, and you can get the necessary exposure without difficulty. The difficulty that the flap of deltoid sometimes is not long enough, did not present itself in my cases.

What is the action of the deltoid afterwards? The fact that the slip of the deltoid contracts when stimulated with the faradic current on the table has no bearing on the function of the muscle, because if you cut a nerve and stimulate it, the muscle will still contract. The cortex and the higher centres do not deal with separate muscles, but with movements. What you actually do by this operation is to put a nice big lump of ragged muscle under the capsule, and the effect is to strengthen the part, and in addition as you will probably have some haemorrhage you will get still further strengthening by the formation of some fibrous tissue. I think that the results of this operation depend on the pad of muscle, rather than on any specific action of the transplanted slip.

Mr. Harry Platt: I have done this operation once—five years ago. The result illustrates certain mistakes which are easily made. My deltoid flap was too short and thick because I did not divide the muscle close to its bony insertion. As Mr. Ollerenshaw has pointed out the flap should be thin in order that it may be pulled through the quadrilateral space easily. In my operation the result was successful in that there was no recurrence of the dislocation but the man who was a professional acrobat was unable to return to the stage. He had lost so much deltoid that his shoulder joint musculature was incapable of bearing the full brunt of his gymnastic manoeuvres. He entered the army but I believe in a comparatively low category.

Mr. W. H. Trethowan: I have no experience of this operation. I have opened only two cases of dislocation of the shoulder: one was the case of an officer at Shepherd's Bush, and the other a private case, a lady who had had a dislocation about every month for 18 months or two years. I agree with Mr. Bristow, if you cut off the nerve supply of the deltoid, it only acts as a bundle of fibrous tissue. I started to do it, but being sceptical, I plicated. In the first case I went below the subscapularis, and in the second one, above it. What interested me was the condition of the capsule. I expected to find a hernial sac, but there was a general distension of the joint, and one wondered why it dislocated. There is no local distension. Another matter was the great difficulty of plicating, and one doubted whether plication in these previous cases had been done well enough. Finally we got a fold ⅝ inch deep by digging up, keeping half-a-dozen forceps on. It was difficult to get good strong stitches in. Unless you plicate properly, it is useless to attempt it. I plicated them both—one twelve months ago, the other fifteen months ago. I have not heard that they have relapsed since. They are much too recent to base any valuable opinion upon. It is the difficulty of getting a fold which I think may have caused relapse in these cases.

SYPHILITIC AND TUBERCULOUS JOINTS

By Percy Willard Roberts, M. D., New York

During the past few years I have observed more than two hundred cases of chronic destructive joint disease with symptoms usually ascribed to tuberculosis which, from their behavior under mercury and potassium iodide, their suggestive family histories and the presence in many of dental stigmata, it is reasonable to believe were syphilitic. This material has yielded a number of interesting facts which were discussed at some length in an article published in the American Journal of Syphilis for April, 1920.

For the purpose of this communication the essential features of the deductions arrived at may be summarized as follows:

First, there was abundant confirmation of the opinions expressed many years ago by Gibley, Ridlon, Whitman, Sayre and others that cases of joint syphilis cannot be distinguished clinically from tuberculosis. My experience leads me to go further than this and to say that the symptomatology and radiographic findings of these two diseases is usually so nearly identical that to make a diagnosis of tuberculous joint disease without first eliminating the possible presence of syphilis invites serious error which jeopardizes the welfare of the patient.

Second, the Wasserman test upon which so much reliance is placed in the diagnosis, of acquired syphilis, is of comparatively little help in the late manifestations of inherited lues. In forty-seven cases where symptoms subsided under mixed treatment and where often there was a positive family history and other stigmata of lues, Wasserman tests made with an alcoholic antigen gave eleven weak positives and thirty-six negatives. The same bloods treated with cholesterinized antigens gave thirty-three positives from one to four plus and fourteen negatives.

Third, the medical treatment of cases of this nature does not differ materially from that of acquired syphilis. The cardinal points are to crowd whatever drugs may be used to the limit of tolerance and to continue treatment for at least a year after all symptoms have subsided. There are two great dangers of relapse. One is the premature abandonment of vigorous therapy and the other severe trauma. The latter is always a menace, as children may feel perfectly well and be apparently normal long before their bone lesions are completely healed.

Fourth, the orthopedic treatment of these cases varies somewhat from that usually employed in tuberculosis as the goal aimed at is quite different. In tuberculosis a firmly ankylosed joint is generally desirable as tissue regeneration is not to be expected. In syphilis, on the other hand, replacement of necrotic bone areas may occur with the restoration of practical function. Therefore weight-bearing joints should not be maintained indefinitely in plaster casts and the patient allowed to walk. Removable braces which will prevent weight bearing and allow motion in the joints when the patients are lying down are preferable. So, also, are removeable splints for the upper extremities, in order that voluntary motion at prescribed intervals may be carried out after the acute symptoms have subsided. Spine cases should, of course, be continuously immobilized until the radiograph shows solidification of the diseased bone.

In fifty-one of my cases a diagnosis of tuberculosis had been made by twenty-six surgeons, and had been under treatment for from six months to twenty-five years and yet all of them showed marked improvement under the use of mercury and potassium iodide and many of them became symptom free.

Brief outlines of five extreme cases, previously published, will illustrate the danger of ignoring inherited syphilis in considering a case of chronic destructive joint disease.

CASE 1. W. U. Previous diagnosis "tuberculous left elbow;" duration two years; joint ankylosed at a right angle; had been operated for abcess and lower end of humerus curetted. At the beginning of treatment the elbow was firmly ankylosed and a sinus had been discharging for two months. Four months later there was complete restoration of function. The Wasserman was negative, but the patient's sister, two years older, had a positive blood and three years later was sent to a hospital for the insane.

CASE 2. C. B. Age 8. Hospital diagnosis "tuberculous right knee;" duration of disease six years; previous treatment, continuous immobilization in plaster casts. At the beginning of medication the knee was stiff, swollen and tender and had about ten degrees of motion. A radiograph showed a large necrotic area in the head of the tibia involving the joint surface. Patient was given hydrarg. chlor, corr, gr. 1/32 and potassium iodide grs. x, three times a day. Three weeks later the pain and spasm had largely disappeared and there was voluntary motion to nearly a right angle.

Child has been symptom free for two years and radiograph shows practically complete bone regeneration. One Wasserman was negative and another weakly positive.

CASE 3. E. M. Age 14. Treated ten years for tuberculous knee, wearing plaster or braces all the time. Radiography showed necrotic areas in the head of the left tibia. When the patient came under observation the knee was enlarged and tender and had about ten degrees of motion accompanied by pain and spasm. She was given 1/32 gr. of hydrarg. chlor. corr. and 10 grs. of k. i. three times a day. The brace was continued two weeks, at the end of which time pain and swelling were considerably less and there was 80 degrees of joint motion. Brace removed and was not again worn. In three and a half months the patient was symptom free and had nearly normal joint function. Family history and Wasserman both positive for syphilis. A year later radiographic examination showed regeneration of necrotic areas in the head of the tibia. There has been no return of joint symptoms.

CASE 4. Age 20. Had been treated for tuberculosis of spine for fifteen years, having worn jackets and braces and had a bone graft inserted in the spinous processes, which did not take. He had been bed-ridden for a year and had seven profusely discharging sinuses. In ten weeks he was able to take long walks, three sinuses had closed completely and the others were discharging a small amount of thin fluid, and he had gained sixteen pounds in weight.

CASE 5. H. F. Age 31. Hospital diagnosis "tuberculous hip disease;" duration twenty-five years; active treatment for ten years; has had more or less pain ever since which was particularly severe for several months before he was placed on mixed treatment January 2, 1918. Nine days later the pain was very much less and the patient slept well for the first time in several weeks. January 23, 1918, the patient reported himself as symptom free. Two years later he reported that he had continued treatment during the interval and had been perfectly comfortable. He had never before known what it was to be well. His Wasserman was two plus.

AN UNUSUAL ABNORMALITY OF THE ELBOW JOINT

By Lloyd T. Brown, M. D., F. A. C. S.

This case is reported because it brings out the fact that the human machine may do its work for many years although in it there may be present an abnormality or a deformity which is the potential of much disability. This potential of disability may never be more than a potential until some circumstance occurs which causes an unaccustomed use or a strain and thereby starts the trouble going.

The patient was an athlete and had played college football and baseball and entered into all possible sports; baseball was his favorite game. At the time he was first seen, in March, 1916, he was a physical director in a N. E. State College. Nine months before this while running down a flight of stairs with a golf bag in his hand, he tripped, striking his right elbow on a cement walk. In spite of this injury he played 3 or 4 rounds of golf without any difficulty. Later in the day while throwing a baseball the right elbow suddenly "gave way as if it were paralyzed" and he has never been able to throw a ball with a snap to his elbow since that time. The arm has been gradually drawing up since the injury so that he has increasingly less motion. He continued his athletics during the fall, hurting it a few times while playing football and basketball. After these injuries the arm would be definitely worse and he would have less motion. He could always improve this motion by baking and massage.

Physical examination showed a big husky athletic man in excellent physical condition except that he was a little over-weight. Other than this the examination was negative except for the right elbow. The right elbow was negative to inspection. By palpation no thickening could be made out, and the bony land-marks were the same as on the other elbow. The motions were limited as follows: Extension to 150 degrees; flexion so that the hand could be placed just below the right ear. This limitation seemed to be due very largely to protective muscle spasm. There was no limitation of supination or pronation. An X-ray (See Figure 1) showed in the antero-posterior view, a large abnormality or spur formation of the inner side of the ulna at the joint line. This spur was so large that it overlapped and curved around the internal side of the trochlea surface of the humerus. At the tip of this spur was

a small bony mass which was not connected by bone trabeculae to the spur. There was also a slight amount of hypertrophic arthritis at other parts of the joint. The lateral picture was negative.

The patient could not give up the time for any operative procedure so a carefully fitted brace was made which would prevent either extreme flexion or extension.

The patient was next seen 6 months later when he said he had not been able to keep the brace in place because of the shape of his arm. The motions at this time were more restricted. Flexion was

FIG. 1.—Anteor-posterior view before operation. Note the spur-like abnormality of the ulna.

limited to 75 degrees so that he could only with difficulty touch the lower end of his ear and extension was limited to 130 degrees. Because of his college work he could do nothing about his arm at this time. Four months after this the motion was still further limited. Flexion to 85 degrees and extension to 115 degrees.

This being the time when all the young men were enlisting the patient came again the following month, saying he wanted an operation because his elbow had made impossible any kind of enlistment.

In August, 1917, an operation was performed. Ether was used as the anaesthetic. A three-inch incision was made from the inner border of the olecranon down the shaft of the ulna. The olecranon bursa was found to be entirely absent and the tissue in this region was jagged and torn as if it had been severely bruised many times. The muscles and ligaments were then subperiosteally scraped off the internal condyle of the humerus and the olecranon, and the shaft of the ulna so that the abnormality was fully exposed. It was found to extend laterally upward toward the internal epicondyle of the humerus 1¼ inches, becoming smaller as it neared the upper end. At the base it was about ¾ of an inch wide. The abnormality was removed with an osteotome. About ¼ inch from the tip of it there was a cartilaginous mass about ¼ inch wide and ¾ inch long which extended into the joint between the coracoid process and the humerus. This mass definitely impinged in both flexion and extension of the joint. When this was removed the joint could be flexed so the hand touched the shoulder, and almost complete extension could be obtained. In making these motions some adhesions were broken. The part of the abnormality which articulated with the internal or lateral side of the trochlear surface of the humerus was covered with smooth and glistening cartilage. The trochlear surface where it articulated with the abnormality was likewise covered with smooth, glistening cartilage.

The periosteum and muscles were sutured together with catgut. The skin was sewed with silk-worm gut, and a large dry dressing and bandage were applied.

The convalescence was uneventful. In two weeks from the day of operation he had motion from 75 degrees flexion to 138 degrees extension. After baking this could be further extended to 160 degrees. In four months extension was possible to 170° and flexion to 45°. These angles were taken with a goniometer.

Figure II shows an antero-posterior view taken four months after the operation.

The latest report of the condition of the elbow was by letter dated March 15, 1920 and this said," My arm is as good as ever and think that it is practically straight."

As was stated at the beginning of this paper, the point of interest is not so much the abnormality which could be considered only a potential of trouble, as it had undoubtedly been present for many years without symptoms, but the fact that an injury which was not severe enough to cause an immediate disability, so impaired the ordinary mechanics of this abnormal joint, that the repeated slight injuries due to ordinary usage, caused enough irritation to increasingly limit the joint motion and function.

Fig. 2.—Four months after operation. Antero-posterior view.

OPENING REMARKS ON BIRTH PARALYSIS

By Harry Platt, M. S., F. R. C. S.

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Paper read before the British Orthopaedic Association, November 14th, 1919, as part of the discussion on Birth Paralysis.

Mr. President and Gentlemen:

The subject of Birth Paralysis is one which in this country Mr. Fairbank has made peculiarly his own and it is therefore appropriate that our Association should have the opportunity of hearing his authoritative exposition on this important civil orthopaedic problem. Since 1913 there has been a marked revival of interest in Birth paralysis, particularly amongst orthopaedic surgeons.

I propose to limit myself today to a consideration of the diverse views which now exist concerning the exact nature and site of the lesion present in obstetrical paralysis and to indicate how far my own observations agree with or differ from the current conceptions; as a natural corollary I shall deal briefly with the question of treatment and especially with those points raised by Mr. Fairbank. My own work has been based on clinical observations made on a series of 23 cases of birth palsy which have been under my care during the past five years and also on experiments carried out in the Anatomical Department of the University of Manchester on the mechanism of the production of the lesion under consideration.

Pathogensis

Although in 1889 Kustner propounded a view that displacement of the upper humeral epiphysis was the underlying lesion present in birth palsy, the original conceptions of Erb and Duchenne of a supraclavicular lesion of the Brachial Plexus held undisputed sway until 1912. The operation findings of Kennedy of Glasgow and others seemed to maintain these conceptions beyond all doubt. Lange of Munich, impressed by the transient paralytic

phenomena in so many cases and by the secondary distortion of the arm seen so constantly, boldly claimed that here was a primary lesion of the shoulder joint capsule; he further stated that the paralysis was merely apparent and that there was no actual nerve trunk lesion. Turner Thomas of Philadelphia in 1914 adopted a similar explanation, except that he brought forward reasons in favour of a theory of the production of the shoulder joint injury in utero by the compression of the maternal pelvis. Turner considered that the paralytic symptoms were genuine and due to a temporary compression of the supraclavicular nerve cords by the exudate and scar tissue derived from the lacerated joint capsule. The evidence adduced by Thomas for the prenatal occurrence of the lesion is to my mind unsound and as I have already discussed this in a previous communication, I do not intend at the moment to deal with it in detail. About this time Vulpius revived the old theory of Kustner and avoided any explanation of the apparent paralysis beyond the statement that it was secondary and an unimportant feature in the clinical syndrome. We thus see the growth of two schools, one maintaining that all cases of birth palsy are primary lesions of the supraclavicular brachial plexus and the other, that all cases are primary lesions of the shoulder joint capsule or upper epiphysis of the humerus. Peltesohn adopted a via media and after a careful study of 11 cases distinguished two groups—true and false paralysis. The true paralysis were characterised by the absence of contractures, the presence of free mobility, and the occurrence of definite paralysis and wasting of the muscle group concerned. In the false palsy cases he noted the absence of true paralysis and muscle atrophy, and the presence of fixed contractures; in these latter cases radiograms showed definite evidence of displacement of the upper epiphysis of the humerus. Peltesohn considers that the displacement of the epiphysis at a later stage forms an undue posterior projection under the acromion, thus explaining the physical sign noted originally by Whitman and regarded by most observers as a subluxation of the shoulder joint secondary to the paralysis. Van Neck from a study of 14 cases has distinguished 4 groups:

(a) True paralysis, 3 cases.
(b) Shoulder joint torsion, 2 cases.
(c) Epiphysial lesions, 5 cases.
(d) Congenital deficiencies in the Brachial Plexus, 4 cases.

He states that true paralysis always leads to the development of contractures, thus maintaining a view exactly opposite to that of Peltesohn. The epiphysial lesions noted by Van Neck included separation of the upper epiphysis of the humerus and intra-epiphyseal fractures, both lesions being recognisable in good radiograms. This author further points out that in the new born infant the differential diagnosis between these different types of lesion is impossible; this statement will, I think, be subscribed to by most observers.

Sever in 1916 collected all reported cases of birth palsy up to date and in addition to emphasising the frequent occurrence of subluxation of the shoulder, repeated the original experiments of Clarke, Taylor and Prout who in 1905 had studied the effects of violent traction on the head in the infant cadaver. Sever's observations left him in no doubt as to the occurrence of a supraclavicular lesion of the brachial plexus in all cases of birth palsy but he recognised the tendency towards spontaneous recovery of the paralytic signs. Ashhurst in a very able paper last year, concluded that supraclavicular lesions of the brachial plexus do occur but are infrequent, and that most cases of birth palsy are "terminal" nerve lesions and depend on a co-existent shoulder joint capsule injury, the muscles paralysed being those supplied by nerve trunks or branches in close proximity to the joint: namely suprascapular, circumflex, musculo-spiral and musculo-cutaneous nerves. Furthermore Ashhurst declares that the nerve lesion in birth paralysis requires no operative repair.

We have traced the evolution of these conflicting views in some detail because it is surely obvious from a practical standpoint that we, as orthopaedic surgeons, must have a working hypothesis in dealing with these cases and particularly in our teaching. As adherents of the classical theory we may quote Sharpe of New York, who reported in 1916, 56 plexus operations performed in a very short period, and recommended the routine exposure of the brachial plexus at the age of one month in all cases of obstetrical palsy. Taylor, in 1913, reported 43 personal operations on the plexus and also recommended early exploration in young infants owing to the fact that in his opinion spontaneous recovery is uncommon. There is a vast gulf between the conceptions of a primary shoulder joint injury which requires correct postural fixation only to bring about restoration of function in the limb, and a

brachial plexus lesion demanding operative exploration in all or most cases. We thus have to decide whether all cases of birth palsy are due to one type of lesion or if several distinct lesions can be included under this heading. If this latter conception be true we require knowledge upon which we can base a differential diagnosis between the various types. Before considering the evidence for and against the various theories I shall briefly present an analysis of the cases which have been under my observation during the past 5 years.

Analysis of Personal Cases

Of the 23 cases all showed a unilateral affection, the left arm being involved in 13 and the right in 10. A history of difficult labour was present in all but my statistics of the actual presentations are incomplete; in 10 in which I elicited this information 8 were vertex and 2 breech presentations. In 10 instances the child was unusually big, 4 of the infants weighing at birth 14 lbs., 13½ lbs. and 11 lbs. respectively. In 4 cases in addition to the birth palsy symptoms there were associated injuries: a sterno-mastoid haematoma in one case and a fracture of the humerus in 3. The cases in this series may be divided for the purpose of study into 4 groups according to the condition presented at the time of examination.

Group 1. 12 Cases.

In the patients in this group the actual paralysis had recovered and the patients presented the typical subluxation of the shoulder joint with a fixed internal rotation contracture of the arm. The characteristic physical signs were the perfect contour of the limb with the absence of any localized muscle atrophy, the mechanical disablement due simply to the torsion and the general under-development of the limb in length and calibre varying according to the length of time the disability had existed. Spontaneous recovery had been noted by the parents in all these cases; some had received no treatment at all, others had attended hospitals anad undergone a certain amount of massage. In all cases the arm had been bandaged close to the side after birth and maintained in this position for some weeks. No patient had been splinted in what we know to be the correct posture. The problem of treatment in this group was solely that of the contracture and not of a paralysis.

Group 2. 6 Cases.

The cases in this category showed a typical subluxation of the shoulder joint combined with a residual paralysis affecting the extensors of the wrist, fingers and thumb. There was no evidence of existing paralysis or muscle atrophy in the upper arm muscles which had obviously undergone spontaneous recovery. One may note that the paralysis of the extensor group of muscles recovered under postural treatment in 4 out of the 6 cases.

Group 3. 3 Cases.

Case 1. A baby of nine months presented a very flail limb in the usual position of full internal rotation and with a complete paralysis of the deltoid, spinati, biceps, supinators, triceps and extensors of the wrist, fingers and thumb. In addition to the general under-development of the limb there was a slight definite flattening of the contour of the deltoid, triceps and biceps-true localized muscle atrophy. In this patient the position of internal rotation was accompanied by a slight limitation of the range of passive external rotation and there was a distinct bulge of the head of the humerus posteriorly although the difference in the two sides was barely appreciable. I should like to comment on this case that with a severe existing paralysis which so far had shown no signs of recovery there was an internal rotation contracture and an early subluxation of the shoulder joint.

Case 2. A child of 6 weeks with simple wrist drop noted the day of birth after a difficult and prolonged labour; there was here absolutely no evidence of any disability in the upper arm. This patient after one month's treatment on a cock up splint showed manifest recovery and seen two years later showed no evidence of any disability. This is not a typical case of birth paralysis as ordinarily understood but nevertheless was a definite paralytic phenomenon occurring after a difficult labour.

Case 3. A baby of 4 months seen with the typical posture and an apparent upper arm type of paralysis with no contracture or subluxation, after 4 months fixation on a splint in the standard posture of relaxation showed commencing recovery in the deltoid. Two years later he showed complete recovery of the paralysis but with a slight internal rotation contracture un-accompanied by any posterior subluxation of the head of the humerus.

Group 4. 2 Cases

Both patients who were older children, age 13 and 18 respectively showed exceedingly flail limbs.

Case 1. In this child the right arm was profoundly wasted and under-developed, resembling very closely the condition seen in anterior poliomyelitis. There was a complete paralysis of the deltoid, spinati, rhomboids, serratus magnus, biceps and intrinsic muscles of the hand. The shoulder joint was flail and showed the usual downward subluxation of the head of the humerus. The clinical syndrome in this patient indicated without doubt a lesion of the brachial plexus high up above the origin of the nerve supply to the serratus magnus and rhomboids; that is to say a radicular lesion and for practical purposes almost intra-vertebral and therefore to my mind inoperable. In this patient I performed an arthrodesis of the shoulder treating it in the manner comparable to that used for the similar disability following infantile paralysis.

Case 2. This patient, a girl of 18 with a history of difficult labour and paralysis of the left arm noted immediately following birth, showed profound atrophy and lack of development in the left upper limb with a flail shoulder and wrist joint. The only muscles acting in the limb were the deltoid, pectoralis major, biceps, supinator longus, extensors of the fingers and superficial and deep flexors. In this patient I explored the plexus above the clavicle, but without any definite hope of being able to effect direct operative repair. It is interesting to note that there was no trace of any lesion in the supraclavicular triangle, the nerve cords being intact but small and on stimulation giving results identical with the clinical findings. It was obvious in this case that the lesion was high up close to the origin of the nerve roots from the cord and therefore inoperable.

The two patients in this group are exceedingly interesting as flail limbs following birth paralysis are very rarely seen in older children or adults. This has been commented on by several authors and I would suggest that where recovery of the paralysis fails in cases of birth palsy the lesion will be in many cases a lesion of the cervical roots high up above the actual formation of the plexus proper.

I would sum up the points of importance noted in my series of patients as follows:

1. Out of 23 cases, 19 developed the internal rotation contracture of the arm and the posterior subluxation of the shoulder joint. In 18 of these cases the paralysis of the deltoid group recovered spontaneously; on the remaining patient I have no recent observations as the child whilst still under treatment, left the country.

2. In two patients seen many years after the injury a very flail limb with severe muscle wasting as in poliomyelitis, was present.

3. Two cases of simple uncomplicated paralysis showed recovery under correct postural treatment. This brings the number of cases of spontaneous recovery of the paralytic signs to 20 out of 23. I would emphasize once more the tendency towards spontaneous recovery of the paralysis and secondly that the posterior subluxation and the internal rotation contracture of the arm dominates the whole clinical picture of obstetrical palsy.

Discussion of the Theories of Causation

Evidence for the Supraclavicular Plexus Injury Theory.

There can be no doubt that in some cases of birth palsy there is a lesion of the brachial plexus above the clavicle. The evidence on which this is founded is derived from operative, experimental and clinical observations.

(*A*) *Operative Exploration.*

The operative findings of Kennedy, Taylor and Sharpe and others have revealed in the cases explored, lesions of the plexus at or about the junction of the fifth and sixth anterior primary divisions of the cervical nerves. The operation findings quoted by Mr. Fairbank in opening the discussion correspond to those of the authors above named.

(*B*) *Experimental.*

Clarke, Taylor and Prout of New York in 1905 attempted to reproduce on the cadaver lesions of the brachial plexus which were said to be characteristic of birth palsy. These authors found that traction on the head with a fixed shoulder caused the nerve cords in the neck to become taut; on increasing the traction force the uppermost cord was found to fray out or snap; still further force

acted on the lower cords, the degree of tension diminishing from the upper to the lower cords. Laceration of the deep cervical fascia occurred in all experiments in which considerable violence was used.

From these results it was found that 80 per cent of the lesions produced were above the junction of the fifth and sixth cervical anterior primary divisions.

Sever repeated these experiments in 1916 and found that very considerable force was needed to cause rupture of the fifth and sixth cervical nerves; the supraclavicular nerve usually snapped before any other, but in most cases it was found that the nerve sheath only gave way, the nerve bundles proper fraying out inside the sheath without undergoing complete laceration. Sever noted that in order to place extreme tension on the lower cords abduction and elevation of the arm was necessary, thus presupposing a different type of violence for the birth palsy in which the paralysis could be explained by a lower cord injury. Sever was unable to produce a rupture of the shoulder joint capsule, separation of the upper epiphysis or dislocation of the humerus, but found that methylene blue injected into the shoulder joint diffused out through the anterior capsule when this had been divided. The dye percolated into the axilla and surrounded the plexus branches at this level. This latter experiment was carried out in order to refute the view of Turner Thomas who supposed that an exudate from the shoulder joint capsule would travel above the clavicle and therefore produce compression of the nerve trunks at this level.

I have recently been able to carry out similar experiments on still born full time foetuses in the Anatomical Dept. of the University of Manchester, owing to the courtesy of my colleague, Professor J. S. B. Stopford. The foetuses were used fresh without a preliminary injection of any preservative in order to avoid undue shortening or hardening of the soft tissues. All varieties of violence embodying the manoeuvre of separation of the shoulder from the head were employed both before exposing the plexus and after. I found that with the greatest separation between the head and the shoulder there was considerable tension on the fifth, sixth and seventh anterior primary divisions. The suprascapular nerve was not, however, rendered tense before the fifth and sixth nerves.

After division of the clavicle with the free mobility of the shoulder joint now possible I failed to rupture any cord in any

experiment. With regard to the rupture of the sheath and fraying out of the nerve fibres I must say that in these tiny infants it is difficult to recognise macroscopically a lesion of this type. On the closest inspection I was unable to see any evidence of sheath rupture. When the head is flexed laterally and rotated to its point of maximum separation from the shoulder one notes that the transverse processes of the cervical vertebrae are rotated forwards and the scalenus medius mass forms a marked bulge in front. This suggested the possibility of the point of injury of these nerve roots being at the level of the transverse processes, but I could not produce any naked eye lesion at this level. In one instance I caused a rupture of some blood vessels in the intervertebral foramen from which the fifth nerve emerged; the effusion from these vessels trickled down for some little time along the course of the fifth nerve and upper trunk. This occurrence is interesting and perhaps suggestive, but I do not intend to dilate on its potentiality. With regard to the deep cervical fascia I did not note any tearing in any of my experiments. When the maximum point of separation of the head and shoulder has been obtained further violence can be inflicted by traction on the arm. This produced considerable tension on the anterior-inferior portion of the capsule of the shoulder joint, the head of the humerus dropping a little. With excessive force I was unable to produce any dislocation of the shoulder joint, separation of the epiphysis or in fact any demonstrable lesion of the shoulder joint capsule. In this last manoeuvre the position of the circumflex nerve as it runs in contact with the lower part of the shoulder joint capsule suggested its vulnerability. The results of these experiments are on the whole negative and one cannot place too much reliance on their applicability to the actual lesion in the living child. From my own observations it is clear that extreme violence only will produce an actual rupture of the nerve trunks and it seems to me that the point of location of the lesion is likely to be high up, either in the spinal roots proper, in the anterior primary divisions before junction or on the other hand in the terminal branches of the plexus in close relation to the shoulder joint.

(*C*) *Clinical Evidence*

The posture of the arm at birth and the immobility have been explained for a long time as due to a paralysis of the group of muscles supplied by the fifth or fifth, sixth and seventh cervical

nerves. I think we must admit that in young infants immobility alone is not a conclusive proof of true paralysis due to a nerve lesion and certainly not of any one localisation of the supposed nerve lesion. The distribution of the paralysis of the upper arm type of case can be explained equally well by the assumption of a nerve lesion in the axilla in close relation to the shoulder joint. This has been maintained by Ashhurst and I think is a view which requires very careful consideration. In cases where rapid spontaneous recovery occurs especially before the patient is seen by the surgeon it is as logical to assume the existence of a previous infra-clavicular nerve lesion as to assume that of a supra-clavicular lesion. It is in cases where recovery is slow or occurs not at all and particularly where certain muscles show definite paralysis which are supplied by branches arising high up from the plexus that the existence of a supraclavicular lesion is established beyond all doubt. In the same way the pupilary changes noted in a few cases of the lower arm type of paralysis shows the location of the lesion again to be radicular. From a practical standpoint it does not matter in a recovered case whether the site of the lesion is definitely proved, as the proper treatment is that of the contracture of the arm.

(2) *Evidence for Primary Shoulder Joint Lesion*

The posture of the limb in the early stages, the occurrence of a subsequent contracture, the transient paralysis in muscles supplied by nerves in close proximity to the joint capsule, theoretically, can be explained by the assumption of a shoulder joint lesion. We must admit that the bulk of the evidence in favour of the shoulder joint lesion is evidence of a negative type and is based on reasons against the adoption of a supraclavicular plexus lesion for all cases. With regard to the posterior subluxation of the joint which as a clinical phenomenon is an undoubted fact, it is not difficult to explain this sign if a shoulder joint capsule injury be presupposed. Laceration of the antero-inferior part of the capsule by violent traction and torsion of the upper limb would provide all the factors necessary for the production of the fixed contracture and of the slow forcing back of the head of the humerus by the cicatrizing tissue. The actual confirmation of a shoulder joint lesion from operative exploration is, however, lacking. In my own experience of the open operations performed for relief of the sub-

luxation I have seen no signs pointing to the occurrence of a previous laceration of the joint capsule in this region. We may reasonably state that the shoulder joint theory is purely a theory, but is a feasible one and is a satisfactory explanation in a certain proportion of cases of birth palsy.

(3) *Evidence for the Epiphysial Theory.*

The occurrence of epiphysial injuries in cases presenting the clinical syndrome of birth palsy should be possible of proof by radiography. The evidence of most observers is against the frequent occurrence of epiphysial injuries as birth traumata. In my own series of cases the radiograms of the shoulders have shown no changes indicative of an epiphysial injury.

The radiography of small infants is not always a satisfactory procedure and the changes described by Van Neck and Peltesohn are rather meticulous. It is fair to assume that the evidence in favour of pure epiphysial lesions presenting the clinical picture of birth palsy is wanting.

I think that Ashhurst has exaggerated the infrequency of supraclavicular lesions of the plexus but the view that a primary shoulder joint injury with a transient nerve lesion in the neighbourhood of the shoulder joint can explain certain cases of birth palsy is, I think, reasonable. One cannot be dogmatic at the present time, but I would conclude by stating that there is a certain amount of evidence in favour of including under the heading of birth palsy, two distinct groups of lesions.

Treatment

Early Stages. As the evidence available is in favour of the occurrence of spontaneous recovery in the vast majority of cases, the early treatment should be conservative. The limb should be fixed in the standard position of relaxation for a prolonged period. I have little doubt that if this were adopted in every case there would be few cases which show no recovery of the paralytic phenomena, and no case would develop the internal rotation contracture and posterior subluxation of the shoulder joint. With regard to the question of exploration of the plexus, it has been suggested by Mr. Fairbank that if no recovery is manifest in the deltoid group at the end of three months and if the reaction of

degeneration be elicited, the plexus should be explored. I would say dogmatically that the minimum period of one year should be given for conservative treatment, providing that during this period the correct posture is maintained.

I think the extensive experience in peripheral nerve injuries which has fallen to our lot in the past five years has taught us that brachial plexus injuries should be treated conservatively for long periods and that the reaction of degeneration is an unreliable criterion of the existence of a complete nerve block or the inability of a nerve to undergo spontaneous recovery of function.

The technical difficulties of testing the electrical reactions in infants are very much greater than in adults and conclusions drawn from the readings still less reliable. I would suggest that before the supraclavicular plexus is explored in a case of birth palsy there should be in addition to complete paralysis of a muscle group which has persisted for more than 12 months, definite wasting such as is seen in true complete nerve injuries. Where the clinical symptoms indicate a lesion in the region of the intervertebral foramina, I hold that this type of case is inoperable from the point of view of nerve repair and that the resulting disability should be treated by the appropriate procedures such as are used for the residual paralysis of poliomyelitis.

Later Stages

In 17 cases in which I have operated for the relief of the posterior subluxation, in six cases reduction was effected by manipulation and in eleven by the open operation introduced originally by Mr. Fairbank. The functional results on the whole in my own cases have been disappointing; this has been due to the lack of consistent after treatment. In hospital patients spontaneous recovery and increased use in the arm always persuades the parents that no further supervision is needed. When reduction can be achieved by manipulation it is wise to maintain the fixation in plaster for a considerable period; I would say as long as 6 months, as relapse is exceedingly common. After the open operation the period of fixation should be as short as possible—six to eight weeks—as there is a great tendency for cicatricial contracture in and around the shoulder joint capsule. The position I adopt after reduction of subluxation is the standard position of 90° abduction and full

internal rotation. After treatment must be carried out over a prolonged period until the child has full active power of external rotation at the shoulder as there is a danger of the contracture returning.

DISCUSSION.

MR. H. A. T. FAIRBANK opened this discussion by reading the following paper:

REMARKS ON BIRTH PALSY.

BY H. A. T. FAIRBANK, D. S. O., O. B. E., M. S., F. R. C. S., LONDON.

Birth Palsy may be defined as paralysis, usually partial, of the upper limb, the result of injury during birth. In the large series of 471 cases published by Thomas and Sever, the sexes are equally affected, while the right arm was rather more frequently affected than the left in the proportion of 3 to 2.

Labour has usually been difficult, though the paralysis sometimes follows normal labour. Head presentations are recorded much more frequently than breech, in the proportion of nearly 4 to 1.

The early *theories* of the paralysis being the result of direct pressure have been generally discarded in favour of the "traction theory." The supporters of this theory believe that the damage is done by stretching of nerves of the brachial plexus by forcible separation of the head from one shoulder during delivery, or by direct traction on the arm.

Two other theories call for consideration.

In the first, the damage to the shoulder joint is regarded as the primary lesion, and the paralysis as secondary to it. The nerves are said to be damaged either by direct pressure of the displaced humerus (Delbet and Cauchoix)—this theory places the lesions in the terminal branches of the plexus—or by involvement of the plexus in scar tissue formed by the organization of blood that has spread up from the damaged joint capsule. (T. T. Thomas.)

The second theory is that the nerves and the joint are both primarily damaged at birth. (Davis.)

Although the occasional presence of definite adhesions in the joint in young infants suffering from birth palsy strongly suggests damage to the joint in these particular cases, I believe the traction theory best explains the condition present in the vast majority of the cases and that the subluxation of the shoulder joint develops gradually and as a direct result of the paralysis. I hold this view for the following reasons:

1. Tenderness and thickening over the plexus in the neck has been noted soon after birth in some cases.

2. The almost constant finding of definite injury, sometimes amounting to complete rupture, of one or more nerve bundles of the plexus during operation. Those most likely to be damaged by separation of head and shoulder, viz: fifth and sixth cervical, are the ones most found to be paralysed.

3. Experimental evidence that traction can produce tearing of these nerves, and that damage to the shoulder joint is extremely difficult to produce, fracture of the humerus or separation of its upper epiphysis occurring first. (Charles Taylor and Prout, Thomas and Sever, T. T. Thomas, and Stone.)

4. Taylor actually felt the plexus tear during delivery of a child, and the lesion was proved post mortem.

5. Subluxation of the joint is extremely rarely seen at birth, but its gradual development and fixation can be traced through cases of increasing age, the subluxation at first being reducible and becoming irreducible later.

6. Cases seen soon after birth with undoubted palsy and no joint injury have returned after some months with the palsy recovered but the joint sub-

luxated. In almost every case a history is given strongly suggesting an antecedent palsy.

7. Thomas and Sever in cadavers injected methylene blue into shoulder joint and then ruptured the anterior part of capsule. The blue never reached the nerves in the neck, where the lesions are usually found.

8. In seven cases of subluxation of shoulder in which Sharpe operated upon the nerves, a nerve lesion was found in all.

The *pathological* lesion varies from a slight tear of the peirineural sheath and haemorrhage into the nerve to complete rupture of the nerve trunk. Taylor found the sheath buckled inwards and preventing reunion of the nerve filaments. The site of the lesion varies in different cases though most observers agree that the fifth and sixth cervical nerves are more commonly affected than the others, and that the maximum damage is most often at the point of junction of these two nerves or immediately above it.

In some cases, usually those with extensive damage and paralysis, the lesions are close to the spinal cord, or the latter itself may be injured by the nerves having been literally pulled out by their roots. Boyer published a case of extensive damage to the cord and nerves while he and Burr believe that damage to the cord in these cases is not so uncommon as is usually supposed.

Types.

There are, of course, three clinical types, "the upper arm" (Erb. Duckam) "the lower arm" (Klumpke), and "the whole arm." The first is by far the commonest, the strain having been born by the highest nerves, the fifth and sixth cervical. The position of the limb is typical. The arm hangs vertically in full internal rotation, and with the forearm pronated and the palm looking outwards and the fingers usually clenched. The muscles chiefly affected spinati, deltoid, biceps and brachialis anticus, and supinator longus, i. e., the abductors and external rotators of the shoulder, flexors of elbow, and supinators of the forearm and sometimes the radial extensors of the wrist. The serratus magnus is not uncommonly affected to a considerable extent. The rigid dity sometimes met with is due to contraction of the unparalysed muscles and may result from tenderness in the neck over the site of the damaged nerves. I do not think we can quite exclude the possibility of damage to the shoulder joint in some cases, though subluxation is absent. At first passive movements of all the joints are usually free, but within a few weeks external rotation of the humerus, abduction of the shoulder, flexion of the elbow and supination of forearm become limited. As these contractures occur posterior subluxation of the shoulder gradually develops. To this I will return later. The vast majority of these cases recover almost completely though the supervention of a posterior subluxation is certain if adequate treatment has not been adopted. This deformity can, and should be, avoided. It is not uncommon to find wrist-drop as the sole remaining sign of the paralysis, all the other muscles having recovered, and associated with it is the usual sublnxation of the shoulder.

The whole arm type is much more uncommon, while a paralysis limited to the lower nerves of the plexus only and due to traction on the fully abducted arm is even more rare. The prognosis in these is much less favorable than the upper arm type, particularly in lesions of the lower nerves. Sever says the lower nerves practically never recover. In these cases, in addition to the paralysis of all or some of the muscles of the arm the fibres going to the cervical sympathetic from these lower nerves may be paralysed leading to an active contracted pupil and narrowing of the palpebral fissure. Sever found partial or complete paralysis of the hand in 5% of 394 cases. As to the nerves commonly affected fifth and sixth cervical are undoubtedly those most often damaged. More rarely seventh cervical is implicated as well and still more rarely the whole plexus, while most rare of all is a lesion affecting the lower nerves only. It seems impossible to tell in most cases whether fifth cervical alone or fifth and sixth cervical together are damaged. Undoubtedly the bulk of the nerve supply

to the muscles paralysed in a typical case is derived from the fifth cervical. Harris and Low proved by operation in 4 cases that a lesion of fifth cervical alone can produce a typical palsy. They also proved that the fifth cervical sometimes supplies the radial extensors of the wrist.

As to the *treatment of the palsy* I always put the arm up with right-angle abduction and full external rotation of the shoulder, flexion of the elbow to a right-angle, full supination, and if necessary dorsi flexion of the wrist. I use this splint made of tin. The arm is taken down twice daily for massage and manipulations. The manipulations necessary are:

1. External rotation with and without abduction at the shoulder. This is the most important.

2. Full flexion and extension of the elbow.

3. Full supination of the forearm.

4. Dorsi flexion of wrist and fingers.

5. Adduction of the externally rotated arm while the scapula is depressed by a hand on the shoulder. This last is more necessary in the later stages, when recovery of the paralysis has occurred to a large extent, as tilting up of the scapula is one of the most frequent residual deformities. A tendency to winging of that bone is a not uncommon accompaniment.

How long should this treatment be carried on? Till all the muscles have recovered and all movements can be performed and all tendency to contracture has apparently disappeared. In a case seen in the first month of life the period necessary is about three months. The splint should then be removed for increasing periods each day till it is only worn at night and these changes should extend over a further three to six months. Later the splint may be discarded altogether but the manipulations should be carried out daily by the nurse, with a visit to the surgeon every three to six months, for the next two or three years. This may seem to be prolonging the treatment unduly, but my experience of cases regarded as cured before the war and seen recently, after a five years interval, with contracture developed, force one into emphasizing the importance of care in deciding that no further supervision is necessary.

At what age should exploration upon the plexus be under taken? If a case has been treated from the first, and after three months there is no sign of recovery, by physical examination and electrical tests under an anaesthetic, I think operation is advisable. Many surgeons consider three months too early. The age favoured by writers on this subject vary from two to twelve months. I am convinced that in most recovery is well advanced by the age of three months, and I think that rarely are the recognisable signs of recovery delayed beyond this period. Sharpe advises that cases of the whole arm type should be operated upon early (1 month). Although I admit that it is rare to find anything like complete recovery in a case of this general paralysis and that the presence of complete rupture of one or more nerves is not improbable, I think these cases do not lend themselves to radical operation in early infancy, for the operation is often difficult and prolonged, and several nerves will be found partially, though not completely, interrupted and lying in a mass of scar tissue, and when tests are made by direct electrical stimulation no exsection of damaged nerves will be considered advisable. The plexus is best explored through a transverse incision in one of the creases of the neck, converted into a T, with division of the clavicle, if difficulty is experienced in reaching healthy nerves below. If a nerve is found torn through, paring of the ends and secondary suture is the obvious treatment. The supra-scapular nerve must always receive careful attention and every effort made to suture it accurately. If a partial tear indicated by a neuromatous swelling on the nerves is present, the condition of the nerve fibres should be investigated by direct stimulation. Unless the condition of the nerves proves far better than clinical examination led you to expect, as may happen in a very fat baby, excision of the damaged parts and secondary suture is probably the right course to pursue. If the damage is so extensive that after excision the ends could not be brought together, the decision must depend on

the number of nerves damaged. If conduction in the fifth and sixth cervical is completely interrupted and seventh cervical is healthy I should prefer to leave sixth alone and graft the distal end of fifth cervical into a transverse cut in seventh cervical. If seventh cervical were also damaged I should leave the case alone. I do not approve of excision of the whole plexus and bridging the gaps in the nerves with catgut as done by Taylor.

If the lesion is near the cord and beyond the surgeon's reach I should perform a nerve anastomosis as was done in one of my cases, where fifth cervical was grafted into seventh cervical. Seventh cervical was chosen because apparently healthy, whereas sixth cervical was partially paralysed. The result when seen after 10 years was partial recovery of voluntary power in deltoid, both spinati, biceps and brachialis anticus, but not in supraspinatus. In the case of poliomyelitis in which a similar anastomosis was made, the result was similar though recovery of power was somewhat greater. In this case also the supinator remained paralysed. Freeing the damaged portions of the plexus is, of course, a necessary part of the operation, but I very much doubt if this procedure alone makes any difference to the prognosis. The same may be said of incising the nerve longitudinally. The loss of conductivity of fibres which are not actually torn is due to intraneural fibrosis and not to compression of the sheath, so incision cannot relieve the fibres in any way. The head must be approximated to the shoulder for two or three weeks after operation. Sharpe's method of approximating the hand of the affected arm to the opposite ear, by strapping, etc., seems good.

As to the findings of the five cases I operated upon they are shown in this diagram of the plexus. In case

1. Fifth and sixth cervical were torn through immediately above their junction. Secondary suture was performed at the age of 12 months. Three years later, the deltoid, biceps, brachialis anticus and intraspinatus were acting. At the present time, 13 years after the operation, and with practically no treatment in the meantime, he has limited external rotation and abduction of the shoulder, but all the muscles previously paralysed are acting except the extensors of the thumb.

2. Eight months old. The whole plexus was scarred and embedded in a mass of fibrous tissue.

Six years later, he appeared with a subluxated shoulder which was corrected by operation.

Now, after 13 years the arm is not very useful, owing to general weakness, particularly of the deltoid.

3. A doubtful case, but the right arm was absolutely powerless at birth but could move fingers when first seen at 18 months. Both arms were affected, and there was considerable rigidity and limitation of flexion at both elbows.

Both plexuses were explored, and nothing seen wrong with either, but on the left side fifth and sixth gave no response to stimulation, so they were divided at their junction and stitched into the seventh cervical. On the right, nothing was done, as each nerve gave some small amount of response. Three years later, the right arm had improved a little but the left was the same. It is possible that this was a congenital condition, and not due to injury at birth.

4. At 9 months, the typical muscles were paralysed and failed to respond to faradism. At operation nerves looked normal but stimulation of fifth and sixth cervical gave no response except in extensors of wrist. Fifth cervical was divided and the distal end anastomosed with seventh cervical (transverse slit). Eighteen months later there was no return of power in paralysed muscles but ten years later there was very considerable improvement, all the paralysed muscles acting and responding to faradism except the supinators. In flexing the elbow he still used the radial extensors, though biceps was acting.

The opposite arm was affected with poliomyelitis at the age of 7. (Photo.)

5. Operated upon in January, 1910, at 10 months, and fifth cervical was found scarred and adherent at the outer border of scalenus anticus. Phrenic was adherent to it and in fact apparently more damaged than fifth cervical. These nerves were freed and a twig from fifth cervical to phrenic preserved. Stimulation of the fifth cervical produced definite feeble contraction in deltoid (anterior part particularly) biceps, supinator longus and infra spinatus. The sheath of fifth cervical was incised, one definite constricting band being divided. Fifth cervical and phrenic were wrapped in Cargile membrane. This case was lost sight of three months later. The diaphragm was not paralysed on one side.

Kennedy has published some very satisfactory results after excision of the scar and secondary suture. In cases operated upon two or three months after birth obvious signs of return of power and response to faradism were noticed in about three months. Those operated upon later took longer to recover. Taylor also reports some promising results. In one case he excised the whole plexus and bridged the gaps with catgut, the whole being surrounded with Cargile membrane. Several muscles were acting a year later.

Now we have to consider the *subluxation*. It occurs in 40% of cases (Ashurst), and in 70% of my series of 60. It is due primarily to the want of support at the back of the joint, that is paresis of the posterior part of the deltoid, and infra-spinatus, or in other words, of the external rotators of the shoulder. It is associated with contracture of the internal rotators, the most important of which, probably because it is nearer the joint, and has the shortest fibres, is the subscapularis. It is possible that the insertion of the subscapularis acts as a fixed point, the head being tilted back as the shaft is flexed by the pectoral, etc. At first efforts at external rotation produce a reduction of the subluxation, but if untreated, the subluxation becomes irreducible. I have seen a reducible subluxation at six weeks, and an irreducible at four months. I have known it develop after six months.

The typical position of the arm is that of slight flexion, slight abduction, and internal rotation at the shoulder joint, with semi flexion of the elbow and pronation of the forearm. With the exception of the external rotators of the shoulder, the muscles previously paralysed have all recovered as a rule, though in some a wrist drop or paralysis of the supinator longus may remain. The scapula is small, is elevated and tilted upwards and slightly winged. On adducting the arm the scapula tilts up even more; in other words, adduction is limited. Abduction is also often limited, abduction plus flexion being much more readily performed, while abduction plus external rotation is quite impossible, owing to the contracture of the subscapularis and also to a less extent of the pectoralis major and teres major. Extension is also limited. Extension of the elbow is often limited though flexion is now full. Supination is sometimes limited, but by no means always. The child cannot turn the palm upwards because of the inability to externally rotate the humerus. The head of the radius in some is dislocated forwards or outwards, and according to Ashurst sometimes backwards. The X-rays up to a year or so show a humerus slightly smaller with the center for the head definiately smaller than that of the other arm, and lying at a lower level. The scapula is small and displaced as already described. Thomas and Sever have described the X-ray finding very fully. They mention a bending downwards and hooking of the acromion and a similar deformity of the coracoid, which I have also observed particularly during operations on the joint. The older the patient the more marked the bony changes.

Although the statement has been criticised by Ashurst and others, I still insist that the subluxation does not occur if the paralysis persists, and by paralysis I mean paralysis of the muscles around the shoulder joint usually paralysed in these cases. The displacement of the scapula must, I think, be due to paresis of the serratus magnus with secondary contracture of the levator anguli scapulae as suggested by Thomas and Sever. Anterior subluxation is said to occur by Thomas and Sever and Sherren, but I have not met with a case. With persistent paralysis the joint is, of course, more or less flail and the humerus might be drawn forwards by the unparalysed part of the pectoral.

Treatment.

If reducible and the child under a year, as is almost invariably the case, the subluxation can be cured in many cases by the use of the splint shown, and vigorous daily stretching of the weak muscles. The elbow and hand must be held well back in line with the shoulders. If this cannot be obtained by these simpler methods or treatment is being inefficiently carried out, it is better to divide the subscapularis right away and not waste time.

When the subluxation is irreducible I have not had any success with bloodless manipulations under an anaesthetic. Even Whitman and others who prefer this method admit the strong tendency to relapse after it. I prefer to divide the contracted muscles and other tissues through an anterior incision as described six years ago. The joint is reached by the usual incision between the pectoral and deltoid. The tendon of the biceps being diminutive in these cases, I prefer to expose it at the top of its groove so that its exact whereabouts is known. The joint is then opened just above the tendon of the subscapularis and as near as possible to its insertion, and this muscle together with the contracted capsule divided on an aneurysm needle passed down beneath them. At once the humerus can be rotated out and the head of the bone glides forward to its normal situation. If, as is usually the case, adduction is imperfect the coraco-humeral ligament is divided close to the thin biceps tendon, and even the supraspinatus may require division. I have not found it necessary to divide the pectoral completely nor the teres major, though they should be divided if they offer great resistance to combined abduction and external rotation of the humerus.

I used to follow Whitman and fix the limb in plaster for three months with the elbow to the side and well back, the humerus rotated out fully, the elbow at a right angle, and the forearm supinated.

Though this invariably led to cure of the subluxation considerable difficulty was experienced in obtaining both passive and active abduction afterwards, and I now think it is wiser to continue this fixation for only one month. The limb should then be fixed in abducted position in a removable plaster or metal splint, which can be taken off daily for active and passive movements, massage and electrical treatment. Flexion and internal rotation are the two movements requiring caution. With this proviso, the manipulation recommended for the early treatment of birth palsy should be carried out. A removable splint should be worn continuously for at least two months and then gradually discarded, but its use at night had better be continued for some months. I am informed that Whitman now changes the position of the arm from time to time after bloodless reduction of the subluxation. I think careful supervision is necessary so that any tendency to limitation of adduction or abduction can be immediately dealt with by fixation in the appropriate position. Some surgeons regard the pectoral as the chief element in the limitation of rotation and divide this, while osteotomy of the humerus high up (Stone), and below the middle (Hoffa) has been done to correct the internal rotation. The following additional procedures have been recommended by certain surgeons in special cases: division of coraco-brachialis and short head of biceps, cuneiform osteotomy of a hooked acromion (Sever), plication of spinati and teres minor (Ashurst), and plication of posterior capsule (T. T. Thomas). In anterior displacement simple division of the pectoral is recommended by Sever. Apart from the contractures and displacements already mentioned as resulting from the paralysis the following complications are among others mentioned by Sever.

1. Facial palsy by direct pressure of forceps.
2. Fracture of clavicle.
3. Fracture of humerus. One of my cases had this.
4. Dislocation of the head of the radius. This I have seen more than once.

I would add symptomatic wry neck, the head being deflected to relax the damaged nerves, and haematoma of the sternomastoid. I have seen the latter on

the same side as, and on the opposite side to, that on which the plexus is damaged.

In conclusion I venture to suggest the following points for particular discussion:

1. The non-operative treatment of the palsy. In what position and how should the limb be supported?

2. The age at which the operation on the plexus should be done.

3. What operative procedure should be carried out when simple secondary suture is impossible?

4. The cause of the subluxation and its treatment.

Mr. Bristow: There has been one matter mentioned which I would like to say a word upon. It is as to the time at which one should operate. Mr. Fairbank said in three months. On general neurological principles, I think that this is inadvisable, because if you operate at the end of three months you operate from the point of view of diagnosis. It has been laid down by neurologists during the war that operation, in peripheral nerve work, may be considered as part of the diagnosis, and if an experienced surgeon operates under these conditions, he will do no harm. But in the lesions now under discussion, where, in any case, you are likely to find some strange lesion which you can do very little with, I think operation should be delayed to the very last. I think that these cases should be left for a year as a minimum, or 18 months, before attempting suture. Mr. Platt said it is impossible to arrive at a diagnosis as to true paralysis in a child, and he particularly tackled electrical reactions, stating that he had found, during the war, that the electrical reactions were of very little service to him in his peripheral nerve work. I think he is extraordinarily unfortunate, either in regard to the people who carried out the tests for him, and greatly to be blamed in that he did not learn to do them for himself. I do not know what is the general opinion of this meeting, but I do not doubt that one can definitely tell when there is paralysis. When you stimulate on the table you can certainly tell, but when you stimulate through the unbroken skin, coupled with the rest of the examination, the electrical finding is binding. I should be prepared to support that statement in regard to any particular case brought before me.

Mr. R. C. Elmslie: Mr. Platt has appealed to us, as orthopaedic surgeons, to make up our minds as to what should be taught on this subject, and I think it is a very important point on which we ought to make our minds up. We have practically two opposing theories: first the pure nerve theory, and secondly, a theory which presumes some other injury not a nerve injury.

The nerve theory has always seemed to me to fall in very well with our clinical observations in tracing and following up these cases, considering not so much now the late cases which we see with posterior subluxation of the shoulder, but the early cases which we get to treat, those in early infancy.

I think the cases of birth palsy fall, clinically, into three groups: those which recover very quickly, often without treatment, those which recover more slowly, namely, in from three to twelve months, or even longer, and lastly, those which either recover very slowly or not at all or only partially. In my experience, the last group includes very few cases indeed, in fact I think those who do not recover at all are so few as hardly to exist. I have always felt that those three groups fall in very well with three groups of presumed pathological conditions: a condition in which there is injury to the nerve, not involving rupture of axis cylinders, a condition in which there is injury to the nerve involving rupture of axis cylinders, and a condition of injury to axis cylinder and separation of their ends. And I have thought it well to adopt these presumed pathological conditions in teaching on this subject. If we follow out the clinical

course of these cases, those which present contractures and which ultimately tend to get subluxation of the head of the humerus are those in which slow recovery takes place. I have myself watched contracture take place several times. I have seen a child who, at the end of three months from birth, had so much internal rotation contracture of the humerus that an assistant, in attempting external rotation, fractured the humerus. Following up these cases and watching the contracture has led me to believe that the late cases which we see with contracture and with posterior subluxation of the head of the humerus are nothing more than an exaggeration of that condition which is due to lack of early treatment or of continued treatment.

I would like to make a plea for the continuance of that teaching, at least for the present. By all means keep the open mind as to the occurrence of other lesions and injuries and as to the need of investigation concerning such lesions, but if we adopt the position that these are nerve lesions, that they tend to recover more or less rapidly, and that those which recover only slowly tend to end in contracture, we shall be adopting a teaching which will lead to sound treatment, and that is the essential in all our teaching.

Now one word about the operation for subluxation of the humerus. I have always put up the arm in the standard position, and I have been led to do that by considering always the difficulties of external rotation and of elevation of the arm, rather than that fixed position of abduction to which Mr. Fairbank calls attention. And the functional loss is due, I think, mostly to the lack of external rotation. For that reason I have used external rotation in the abducted position.

But what I wished to do was to bear my testimony to the very great value of the operation. I have always connected that operation with Mr. Fairbank's name, and for suitable cases it is an extraordinarily valuable operation. When one has been doing the operation, one has noticed that as the assistant is holding the arm and gently rotating it, at the time you divide the subscapularis it rolls right out immediately. When you do the operation it is at once evident that you have got hold of the real obstruction. I would like to ask Mr. Fairbank whether he can connect the forward subluxation of the head of the radius with the paralysed condition.

Mr. Girdlestone: Mr. Fairbank said he had advocated the transverse incision, but there is great doubt as to where the lesion may be found: it may be high up, or in the middle or low down. So one would advocate in these cases, as for brachial plexus lesions which we meet in military orthopaedics, complete exposure of the brachial plexus with division of the clavicle. By that means one gets the whole plexus under observation, and one can soon see definitely where the lesion is, if one is present there at all. Secondly, by this complete exposure one can secure very much more mobility of the ends after the removal of a large section. Where what Mr. Platt calls the terminations of the plexus are exposed and freed, it is much more possible to bridge this great gap and get end-to-end suture. If we adopt Mr. Bristow's suggestion and only operate on the late cases, then it is in those that there will have to be resection of the ends and approximation of the structures. The advantage of a longitudinal incision along the plexus seems to be great from that point of view, as well as that of the diagnosis of the lesion.

Mr. Aitken: We are deeply indebted to both Mr. Fairbank and Mr. Platt for their papers. I confess I am not well enough up in the literature of the subject to follow Mr. Fairbank's paper until I see it in print and have an opportunity of studying it at leisure. But I express myself as entirely in agreement with the principles which have been laid down by Mr. Elmslie in his remarks in regard to treatment, except that I have never yet performed the open operation for subluxation or extreme internal rotation, which is what I have been inclined to regard it as. But there is one point which, I think, might have been elucidated more clearly, namely, the question of fifth and sixth root haemorrhages. I think we are all agreed that disturbance within the nerve sheath is very easily

produced in nerve trunks. I have paralysed the posterior interosseous nerve by a retractor, and I do not think there is any evidence in the *post mortem* experiments that the force employed in a difficult labour might not produce capillary haemorrhages within the sheath, haemorrhages which would cause considerable pressure. Of this I have seen two examples in adults. One is quite clear in my mind, and the other followed at an interval of a couple of months. Both cases were in working men, who had fallen off a scaffold on the shoulder, and both had a typical fifth and sixth nerve palsy. In one of the cases we considered whether we could cut down on the nerve root when Sir D'Arcy Power said, with that rare diagnostic intuition, "That is a capillary haemorrhage within the trunk: leave it alone, only treating it on general principles, and there will be recovery." Both did recover. And I had a case the other day which reminded me of them. It was the case of a soldier who had been buried at the Front, and he told me he had had transient paralysis of his arm, which had recovered, and in which the injury was evidently something of the same kind.

In regard to the general discussion about these high haemorrhages, I do not know that a sufficiently clear line has been drawn between what are brachial plexus haemorrhages and what has been my idea of birth palsy, lesions within the cord, which may be ante-natal haemorrhages, poliomyelitis, or even in some of the cases, cortical haemorrhages corresponding to birth palsies. In that connection I have a case in a relative of my own who came home from the East at 8 years of age with what I took to be a typical untreated birth palsy. The X-ray picture showed rotation and bending of the radius, with subluxation of the head of the radius. The first thing I tackled was the luxation of the radius, which, by persistent external rotation and flexion, I could drive back into position. On further examination I discovered the merest trace of spasticity of the foot, and then I put the case down not as a mere birth palsy, but a cerebral hemiplegia.

There is another point which I think it might be some advantage to members to refer to, that is the position of the arm in correcting internal rotation or luxation of the shoulder. McMurray, in Liverpool, has devised a very convenient splint, which keeps the arm close to the side. It is divided into two pieces: a shoulder part, and a part for the arm and hand. The upper portion has a chest piece, which prevents internal rotation: one portion slides into the other, somewhat like a trombone. You cannot put it all on in one piece, you cannot get it applied to both ends simultaneously. In one boy born in India whom I didn't see till he came home to school, I was able to place the arm in successive positions in plaster and in that way largely to overcome the internal rotation. During the war I have been treating him at intervals, and I think that possibly had I divided the subscapularis I might have procured the result more quickly. But he is now playing cricket and all other games at an English public school. I was fortunate, in the boy's preparatory and in the public school, to get a gymnastic instructor to deal with the arm by passive rotation and external rotation exercises every day. And I think that in our hospitals where there is a good gymnasium, we get over the difficulty more easily than in Great Ormond Street Children's Hospital, as the exercises can be given for a long period. And there I agree with Mr. Elmslie, that they ought all to be first treated by position. I do not see what good you are likely to do by operating on the brachial plexus, but that may be my obstinacy: my impression has been that the few cases which did not recover were not birth palsy. There, again, it is a question of definition, namely, what you will include in birth palsies: at present I think the margins are not well defined between lesions of the brachial plexus, which I have been in the habit of regarding as "birth palsies" and higher lesions in the cord or brain, which are less amenable to treatment.

Mr. Laming Evans: May I ask Mr. Fairbank a question on one point which he did not make clear to me? I refer to the age-limit at which he has successfully carried out his open operation with reduction and retention. Also, has he found difficulty in retention from secondary deformities, namely, obliquity of the head, or obliquity of the glenoid?

Mr. Fairbank (in reply): I have to thank all the speakers for having given us their views. One or two very kindly criticised the paper.

With regard to the case of subluxation with persistent paralysis quoted by Mr. Platt, it is very difficult to answer: there have been two or three such cases reported. I think Ashurst reported one in which, although he said the paralysis did not recover, I do not think he proved it, according to his own account.

Mr. Platt, I understood, said you could not judge by the results of electrical tests of muscles whether cases had recovered or not. Therefore I think his case also is open to uncertainty: I should have said the subscapularis had recovered in that case. I believe there was only a small tendency to posterior displacement ("Yes"), and it was not a real subluxation: therefore I think one may say the subscapularis had recovered to some extent, but that the other muscles, not having been relaxed as the subscapularis was by the help of the pectoral, had not recovered sufficiently to give the reaction through the skin and subcutaneous fat. I am open to conviction, and admitting this to be an exception, I think my contention does hold good for the vast majority of cases, and that even if this case were admitted, it would be merely the exception which proves the rule.

Mr. Platt seemed to favour the idea of injury of the peripheral nerves, that the terminal branches of the plexus have been injured in connection with the injury of the shoulder joint. But it has always been hard for me to see how that could happen. To injure the nerves running on the front of a joint, presumably you must damage the joint, and the accident to the joint would damage the anterior portion of the capsule. I do not see how displacement of the head of the humerus, or the force exerted on the anterior part of the capsule, can injure those nerves except by hyper-extension of the joint, extending the nerves over the head of the humerus. If this is correct, why should the head of the humerus go towards the back? If you were to tear the anterior part of the capsule, you would expect the head to be displaced forwards. Some have stated that there is injury to the nerves after the humerus is displaced. If it is displaced to the back, it cannot hurt any nerve, except the circumflex. The suprascapular nerve is one particular nerve affected, and this is beyond the reach of damage by the head of the humerus. Hence I cannot understand the theory of direct injury.

Mr. Bristow said three months was too soon to operate, but I think we have to remember we are not dealing with adults. My view is based largely on the experience that in the vast majority of cases there are signs of recovery in three months. The fact that I have only opened five out of sixty shows that I have not 'rushed" at the operation. The child will increase in size: it is not like the case of the adult in which the nerve ends will remain where they are. If the fifth and sixth are torn, if you wait long the nerves will be further apart, and the condition will be harder to deal with than at three months. Therefore I am inclined to retain my idea as to the three months. That has also been advocated by other people, namely, the advantage of operating early before the nerves have separated to a large extent.

In answer to Mr. Elmslie, I agree we should have a more or less agreed line, though we are not likely to agree on everything. I do not agree with him that those cases which recover slowly are those which get subluxation. The child I showed at six weeks had some subluxation.

With regard to the remark concerning the head of the radius, I was at first inclined to regard them as ante-natal conditions. But there is a limitation of extension which is common, and I am sure this develops as a result, or as an accompaniment of the subluxation. Whether any tension on the biceps could help towards that anterior displacement of the head of the radius, I do not know. I have not any satisfactory explanation to offer: all I can think of is tension on the biceps. Someone described a tendency to posterior subluxation on account of long-continued slight flexion and marked pronation. I have not observed that displacement.

With regard to the advocacy of an oblique rather than a transverse incision, I like the transverse one, because I think it gives good exposure in the ordinary

case. If there is any difficulty I make it into a T-shaped incision, and then drill and divide the clavicle.

Mr. Laming Evans asked as to operation on the joint. Those two cases I showed—the boy and girl, aged 9 and 10—were the oldest I have operated upon, and I think the photographs show they were reduced, the boy unquestionably, though the girl I was not quite satisfied with. She was 9 years of age.

THE PRESIDENT: We are very much obliged to Mr. Trethowan for showing these interesting cases. They open up promise for the future, and I hope he will do still more operations of the kind and have better results. We have not time to discuss the matter now.

MR. HARRY PLATT (in reply): I have nothing further of any consequence to add to my previous remarks. What I have attempted was to trace the evolution of the views which are before us today concerning the etiology of this condition —views put forward by men of repute and exceedingly conflicting ones.

The early treatment of cases of birth paralysis fortunately is the same no matter what the exact lesion may be, i. e., fixation of the limb in the standard posture. Mr. Fairbank has found the result of the operative treatment of the subluxation good in that the head of the humerus remains in place. This has been my experience even in older children. The great difficulty however is getting full mobility of the limb apart from the scapula.

Announcements

Dr. Starr, President of the American Orthopedic Association, writes that the clinical day for the June meeting of the American Orthopedic Association is shaping up in good form. It is intended to have a programme which will be both profitable and enjoyable. A large attendance is expected on the first day. The University is co-operating in their desire to make our meeting successful. Arrangements are practically completed to hold the meetings in the Medical department of the University; and as the University is some distance from the hotel, luncheon will be served in the new Hart House dining-hall for the convenience of members.

ORTHOPAEDIC SECTION OF THE CANADIAN MEDICAL ASSOCIATION

June 22nd to 25th, Vancouver, B. C.

PROGRAMME

Dr. V. P. Gibney, "Scope and Development of Orthopaedic Surgery." New York.

Dr. F. H. Albee, "Reconstructive Surgery" (illustrated by moving pictures and lantern slides). New York.

Dr. H. Winnett Orr, "What Can We Do for the 'Hopeless Cripple?'" (Illustrated with lantern slides.) Lincoln, Nebr.

Dr. E. G. Abbott, "Compression Fractures of the Spine." Portland, Maine.

Dr. H. P. H. Galloway, "Treatment of Fracture of Neck of Femur." Winnipeg, Man.

Dr. A. R. MacAusland, "Treatment of Fractures." Boston, Mass.

Dr. James Patterson, "Painful Feet." Vancouver, B. C.

Dr. A. Gibson, "Treatment of Recurrent Dislocation of Shoulder." Winnipeg, Man.

Other papers of interest have been promised.

Personal

The fifth meeting of the International Society of Surgery will be held July 19th to 23d, in Paris, under the presidency of Dr. W. W. Keen, of Philadelphia. Treatment of fractures of the thigh is one of the six subjects assigned for discussion.

At the annual business meeting of the American Posture League, March 13, the following officers were elected: president, Jessie H. Bancroft; vice president, Dr. Frederick R. Green, Chicago; secretary, Dr. Henry Ling Taylor, New York City, and treasurer, Dr. George J. Fisher, New York City. The annual public meeting of the league was held this week concurrently with that of the American Physical Education Association in New York City.

A small experiment station for the study of the problems of invalid occupation has been established at Marblehead, Mass.

The Rizzoli Orthopedic Institute, Bologna, Italy, announces that competition for the prize Umberto I has been opened. The prize of 3,500 lire (normally $700) will be assigned by the provincial council of Bologna for "the best orthopedic work or invention." Both Italian and foreign physicians may take part in this competition. The regulations of the competition will be sent to any one who applies to Dr. G. Zanardi, president of the Rizzoli Institute, Bologna. The competition will close December 31.

Dr. Bernard Barton of Buffalo died on March 28 following a suppurature appendicitis. Dr. Barton improved after operative drainage. The appendix was found to be ruptured. After about a week, however, heart and lung complications arose and proved fatal. Dr. Barton was one of the older members of the American Orthopedic Association. He was usually present at the meetings and always an enthusiastic supporter of its interests and affairs. Moreover he was held in the highest personal esteem by those who were privileged to know him.

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Current Orthopaedic Literature

TREATMENT OF TUBERCULOUS OSTEO-ARTHRITIS BY BONE GRAFTS. By Carlos Robertson Lavalle, Buenos Aires, Argentine. *Surg., Gynec., and Obstetrics,* Vol. XXX, March, 1920, No. 3.

We have passed through the stages of amputation of the diseased limb above the lesion; total resection of the diseased joint—extirpated as one would extirpate a tumor—and a typical resection, the diseased portion being carefully sought out in the articulation and the adjoining bones in order to extirpate them, interfering as little as possible with the cartilaginous line of growth and leaving the bony surfaces in shape thereby facilitating the formation cf a new joint.

Deep cauterization as an alternative for destroying the tuberculous foci, finally provoking cicatrical sclerosis of the lesion; the filling up of curetted cavities; and the use of modifying subcutaneous injections which suffocate and silence the focus sometimes by surrounding it with fluid, making it more easy to draw off the products of infection by repeated puncture—these are all processes which introduce a new period in the history of the treatment of the disease.

The treatment of tuberculin—a biological process practically dominating all former methods—heliotherapy, and rest are today procedures which have proved very successful according to our statistics. These methods have placed an efficacious means of treatment in the hands of any who persistently follow a consistent program of application.

The present method of treatment is non-radical or non-surgical.

The epiphysis is composed of spongy tissue, which is limited on one side by the cartilaginous line of growth and on the other by the articular surface. This surface is not entered by large vessels at any point but receives its blood vessels only from the periosteum covering the lateral and peripheral surfaces of the bone, which is re-enforced by the capsule of the joint, ligaments and tendinous insertions near which there are also blood vessels. When the capsule is overdistended by articular effusion, its vessels are also distended and thus because of their lessened lumen the blood supply to the epiphysis is diminished.

The osseous system is constantly active in a struggle between the osteoblasts, which form bone, and the other elements peculiar to the marrow, the marrow cells and the myeloplaxes, the latter of which give way to the osteoclasts, destroyers of bone; and it is owing to the greater production of osteoblasts that the bone develops in the child. Later, in the adult, the osteoblasts and osteoclasts are produced in equal amounts. In old age, the bone becomes thinner, due to the excess production of the osteoclast. Success in the struggle sways from one side to the other In the different pathological states of the bone marrow.

The embolism which localizes in a bone and which generally comes from a primary focus, especially from a lymphatic gland, provokes a tuberculous marrow infection, that is, the bone marrow is sown with tubercular follicles which undergo mucous degeneration, its elements become embryonic in type, and its

peripheral capillaries are for the time being dilated while the central capillaries near the focus, in which abound tuberculous follicles undergoing degeneration, are obliterated. These lesions produce a rarefying avascular osteitis in the trabeculae of the bone, which is also toxic and partly due to the osteoclast.

The result in the competition of both systems is that the more rarefying the osteitis becomes the less is the intratrabecular marrow helped in its struggle to smother the invader; it is overcome and the tuberculous process gains ground and the alveoli, every day becoming larger, give better protection to the roots of the granulations which, once the cartilage is destroyed or raised, penetrate into the synovial cavity sowing it with tubercles.

These predominant lesions of rarefying osteitis are accompanied by a very accentuated venous stasis and by a reduction of the blood supply through the epiphyseal arterioles, due to oedema of the periosteum to a distention of the soft periarticular tissues and to lesion of mal-position following on reflex muscular contraction—causes which act more especially on the venous walls which are more depressable than those of the arterioles which are already contracted by the action of the tuberculous toxins.

To sum up, we have venous stasis, little flow of arterial blood, extravasated liquids, sluggishness in metabolism, lesions of mal-position through reflex muscular contraction, and rarefying osteitis.

Rest, and here the best results are obtained from continued extension, acts as a depleting agent by uniformly compressing, through the medium of the soft tissues, the articulation and the epiphyseal surfaces, facilitating the reabsorption of the extravasated liquids in the oedematous tissues which have undergone embryonic transformation.

It facilitates, by compression, the circulation of the blood, it lessens the venous stasis for this reason and because it eliminates the congestion that malposition has provoked through reflex muscular contraction. This contraction is overcome by continued extension.

Heliotherapy, apart from its action on the phagocytosis and its general tonic effect, acts as an alterative, since it is well known that the more the skin becomes pigmented the more efficacious is the treatment. This alterative provokes dilation of the vessels, greater rapidity in the blood circulation and therefore reabsorption of exuded liquids which overwhelm the diseased tissues which prevent an efficacious interchange of nutrition and the effective phagocytosis in the struggle against the tuberculous process.

The cautery, by which Charcot has already cured several cases of spinal cord compression due to vertebral osteo arthritis, has proved a good method of replacing effective alterative processes but this is not so far reaching as heliotherapy and is more transitory and discontinuous; there is always a danger of secondary infection.

By therapeutic action we can facilitate an alterative procedure in the periphery of the diseased articulation, increase the arterial circulation and lessen the venous stasis, eliminate the malformations, increase the nutritive interchange and reabsorb the exuded liquids.

The subcortical bone fulfills these two requirements: (1) that of vascularized spongy tissue and (2) that in process of forming new bone; whereas the cortical bone tissue is already more condensed. In the marrow there are two

principal elements, one of vascularized and the other of fatty material, which later, on being traumatized during the severe operation of being compressed with the graft, give rise to large haematomata impeding or retarding the capillary penetration of the graft producing necrosis of the graft, whereby it is reabsorbed.

Convinced of the effectiveness of the use of bone graft when properly applied, we will see how it can be utilized to accomplish its purpose.

1. Because of its trophic action, the graft has the virtue of producing in the surrounding area condensing osteitis, improving the power of latent ossification, which is especially abundant in bones in which there is some inflammatory process such as tuberculous epiphysitis, which weakens when it is not assisted and ends in total rarefying osteitis. Hence a sheet of bony tissue was placed within the epiphysis. This would produce a condensing osteitis and the lessening of the diameters of the osseus alveoli would suffocate the roots of the granulations which had previously taken ample hold but which under the new conditions would atrophy.

2. The graft, placed so as to extend from the diaphysis without touching the articular cavity, would cross the cartilaginos line of growth and as Haver's canals of the graft are rapidly and abundantly penetrated by capillaries, they would serve to overcome the venous congestion and carry arterial blood to the epiphysis. We observe also that the perforation of the cartilaginous line of growth by the bone graft depletes the venous congestion. This is easily established for the epiphysis is practically isolated from the circulatory current, as its articular and diaphyseal faces, covered with cartilage, do not permit the passage of vessels and veins, which go out through the lateral parts of the epiphysis and then are compressed by the oedema of the periosteum. To produce and maintain an active, permanent and aseptic deviation of the blood current, —such as can be secured by means of heliotherapy and which is better than that produced by means of the cautery—and thus combat the epiphyseal venous congestion, two lateral grafts are placed in the cellular subcutaneous tissue surrounding the articulation so that there are points of implantation in bony sites at both extremities of the grafts. These grafts are at once copiously penetrated by capillaries thus depleting the central congestion by the aspiration which this rapid peripheral circulation produces.

The application of extension, bandages, and weights is continued for three months, which have been put on 15 days before intervention so that it will not be necessary to perform the operation in the presence of an active tuberculous lesion. After three months the patient can get up, wearing light plaster band ages which keep the joint immobile.

During all this time, the lateral grafts have been growing and from the size of a toothpick they have become in six months of the breadth and thickness of a rib. The course of the disease is studied by roentgenograms which show clearing up of the rarefying osteitis; and by palpation which shows that the granulations and the pain have also disappeared. At this stage of the subcutaneous lateral supports are removed, and within 10 to 12 days after this slight operation, the patient is turned over to a masseur for treatment to bring back mobility to the point. The joint is not very stiff as play on the normal axes of the articulation has been possible, as muscular contraction no longer exists

and the lateral grafts have molded their extremities into angular shape acting as a pivot.

X ray was given up in later cases and moderate heliotherapy is being used, more as a matter of hygiene and as a general tonic than for its local action.

From the first days following intervention, an improvement can be noted, improvement in the general condition, increase in the color of the mucous membrane, disappearance cf the yellowish tint in the skin, and a better appetite. These are all indications of a lessor quantity cf tuberculous toxins produced and absorbed in the focus.—*Leo C. Donnelly, Detroit.*

TUBERCULOUS HIP WITH CONGENITAL DISLOCATION. U. Caesarono. *La Chirurg. d. organi di movimento*, December, 1919.

Records two examples of tuberculosis developing in congenitally dislocated hips after reduction. In the first case, a child of 2 1-2 years with a double congenital dislocation, reduction was obtained at the first sitting but with some difficulty, more especially with the right hip. Six months afterwards it was noticed that the right hip had a tendency to redislocation, and two and a half months later the child had a painful swollen right hip and an abscess pointing on the lateral aspect of the joint. A radiogram showed partial destruction of the head of the femur, the stump of the neck being in contact with the acetabulum; on the left side the head of the femur was in position in the acetabulum; and showed no abnormality. The abscess was aspirated; tubercle bacilli were found in the thick pus. The right hip-joint was now immobilized securely in a long plaster-of-Paris spica. During the ensuing twelve months the disease became more quiescent. At the end of this period the right hip still showed a sinus in the region of the old abscess; the joint was mobile and the trochanter was elevated; in the radiogram complete disappearance of the head of the femur was evident. The left hip was mobile in all directions and the reduction of the dislocation had been maintained. The second case was also a child of 2½ years, but in this instance the reduction of a bilateral dislocation was effected with ease. After seven months walking was allowed, satisfactory evidence of stability being present. Soon afterwards a light celluloid apparatus was fitted to correct a tendency to anterior transposition in both hips. The patient was not seen again until nine years later. There was a history of a fall on the right hip some months previously and this joint was now painful and swollen. All movements were limited, and in a radiogram the right hip showed complete absence of the head of the femur, the neck being fused to the remains of the acetabulum; the pelvis was extremely atrophic, in striking contrast to the left side. The left hip-joint showed that reduction had been maintained, but was not concentric. An abcess appeared some months afterwards over the right hip; this burst spontaneously and left a sinus, which was unhealed at the time of reporting the case. The author states that out of 2,000 congenital dislocations of the hip-joint treated in the Instituto Ortopedico Rizzoli in Bologna these two cases are the only examples of tuberculous arthritis developing after reduction. He holds that

the connexion between trauma and the local development of tuberculosis is firmly established and that the cases he reports offer convincing evidence of this casual relationship. In the first case the hip in which reduction was difficult, and therefore in which there was a considerable trauma, became the seat of the disease. In the second case long after reduction a definite external injury was the exciting cause.—*From the British Medical Journal.*

THE TREATMENT OF PSEUDOARTHROSIS WITH INJECTIONS OF TINCTURE OF IODINE AND WITH A FENESTRATED PLASTER SPLINT. A. F. Brunzel. *Deutsch. Ztschr. f. Chirurgie*, Bd. 149, H. 5-6. S. 394.

Two methods of treatment of ununited fractures are described in this article. The first consists in the injection of an alcoholic solution of tincture of iodine between the bone ends. He uses a solution consisting of equal parts of a 5% tincture of iodine and 96% alcohol; he injects as much as 20 cc. This injection is given with a small needle so that the point touches the ununited bone ends, penetrates the intervening fibrous tissue and, if possible, the periosteum of the pesudoarthrotic terminals. In each of these three places a few cubic centimeters are injected. The procedure is painful and should therefore be preceded by a local anaesthetic and followed by morphine, about half an hour after the injections are given.

The iodine, the author claims, causes an inflammation between the ends and a fibrous exudation favorable for bone union.

The other method consists in cutting a window in a well fitting plaster splint just over the place of non-union. When the patient walks, the fenestrum fills with edematous tissue which acts like a strong passive hyperemia on the fractured area. The cast must be applied over very little padding and be correctly fitting.

Both methods, especially the latter, have given the author excellent results in many troublesome and long standing cases of pseudoarthrosis.—*A. Gottlieb, San Francisco, Calif.*

INDICATIONS FOR TENDON TRANSPLANTATION AND ITS APPLICATION IN PARALYSIS OF PERIPHERAL NERVES. George Hohman. *Muench. Med. Wochenschrift*, November 26, 1918, No. 48.

The author gives the following indications for the transplantation of tendons in paralysis which result from injury or severance to peripheral nerves:

1. Non-appearance of function two years after nerve suture with perfect healing of the wound.

2. Suppuration of the wound after the nerve is sutured, because it is presumed that the nerve has not perfectly united.

3. Impossibility to suture the nerve in view of the wide gap between the severed nerve ends.

4. Lapse of time for nerve suture. The author takes as a time limit about one and a half years.

5. Nerve injuries near a place where the nerve divides and branches out.

He describes the various methods which he uses for the transplantation of tendons in different regions of the upper and lower extremities and advocates early motion of the operated part.—*A. Gottlieb, San Francisco, Calif.*

Restoration of Loss of Bone, Including an Analysis of the First Hundred Cases of Fracture Treated by Bone Graft at U. S. Army General Hospital No. 3 Colonia, N. J. Fred H. Albee, M. D., Sc. D., Assisted by Elmer P. Weigel, M. D., New York. *Journal A. M. A.*, Vol. 74, No. 9, February 28, 1920.

The surgical repair of bone, and more particularly the use of the bone graft in cases of pseudarthrosis with or without bone loss, is based not only on the ultimate establishment of adequate fixation of the bone fragments, but also on the attainment of a proper bed for the nourishment of the graft. This entails the exact coaptation of parts of the graft to respective parts of the host bone; in other words, the adequate and extensive contact of all four corresponding bone layers, namely periosteum, cortex, endosteum and marrow.

The author has been greatly impressed with the striking influence exerted by mechanical stress on the growth and metabolism of bone. In cases of loss of substance of long duration, in the radius, humerus or any long bone, the bone cortex has often become reduced to one-fifth its normal thickness, almost to egg shell consistency, largely owing to removal of the stimulus of mechanical stress. Such a condition is in direct sequence to the general physiological law of bone growth; it is a magnification of Wolff's law. If bone, whose nourishment and blood supply have not been greatly impaired, should suffer so materially as a result of loss of the stimulus of mechanical stress, how much greater must be the effect of the same inhibitory influences on any free bone graft whose blood supply and nourishment are not yet established.

In work on bone tissues, which easily dry on exposure to the air, operative speed is necessary; in the repair of bone that from lack of the stimulus afforded by mechanical stress has become almost eggshell-like in consistency, great delicacy of technic and operative speed are fundamental requirements in the difficult work of inserting the necessary inlay. It would be impossible to execute such accurate inlay technic by the former laborious methods with mallet and chisel, or osteotome. In work of this nature, in which the operating field is frequently limited, where fragility of bone may be a constant menace to success and in which an accurate cabinet-maker fit of parts is indispensable, an electrically driven rotary twin-saw seems absolutely essential. In contradistinction to a recent assertion, it is emphatically stated that the motor-saw, when properly used, does not heat or glaze the bone. During various operations in the past few months, the author has made repeated attempts to determine whether heat was generated by the motor saw when used properly, and if so, to what degree. In every instance it has been found that the most delicately adjusted thermometers have failed to register an increase in temperature, even to a fraction of a degree, when placed directly on the motor-saw or on the bone immediately following the withdrawal of the instrument.

For the inlay graft, accurately cut and fitted by motor saw technic, the fixation afforded by kangaroo sutures is adequate and preferable to that of all metal agents. The practice of inserting metal plates is absolutely contraindicated in this work.

Of the 100 cases, 79 involved bones in which injury resulted from high explosive shell, machine gun bullet, or shrapnel; 17 were simple fractures of the long bones; the remaining 4 cases were compression fractures of the spinal vertebrae. All the simple fractures and the spine cases have been succssfully treated, in that they have healed, in each instance, without infection, and have shown bone growth by roentgenographic examination within a reasonable period after transplantation of the graft. In every case of fracture of the long bones, function has been restored, while in the spine cases there has been an inhibition of symptoms.

Of the 79 cases of fracture by projectiles, treated by bone graft, 65 or 82% were for loss of substance varying in amount from one-half inch to six inches, and averaging about two inches; 10 cases were for non-union without loss of bone; the remaining 4 cases were of mal-union.

Owing to the exposure of the upper part of the body in trench warfare, shoulder injuries, and particularly those involving the upper part of the humerus, have been frequent in the recent war. Through the rather extensive practice of certain surgeons at the front, more especially of the French, of removing large portions of bone at or near the shoulder-joint in such injuries as these, there has resulted a notable group of cases in which shoulder function is very nearly negligible, if not entirely destroyed, on account of the loss of bony framework over which the shoulder muscles might play.

The high frequency of shoulder and forearm injuries compared with those of the lower extremity has occurred in a ratio of 4 to 1 in 79 cases. Of the total number of injuries in the upper extremity, the humerus has been involved in 14 instances, or more than 25%. Cases of loss of substance in the humerus with loss of shoulder function have been classified in two groups, with respect to treatment:

Group 1. Restoration of Shoulder Motion and Function: This class consists of cases in which the humerus has been destroyed, but the musculature has been sufficiently preserved to enable the surgeon to hope for a return of shoulder-joint motion and function, provided the bone be replaced. The author has restored motion and function in such cases by transplanting into the humeral fragment the head and upper end of the fibula to replace the upper portion of the humerus that has been destroyed. He has resorted to this operation many times in his civil practice, as well as in military work, and has invariably found that the patient can functionate satisfactorily without the upper end of the fibula. Whenever possible, the principal muscles of the shoulder, such as the pectoralis major, the supraspinatus and the subscapularis, are firmly affixed subperiosteally to the transplanted head and neck of the fibula.

Group 2. Shoulder Function Restored by Compensatory Scapulo-thoracic Motion. This group includes cases in which, in addition to loss of bone, the musculature of the shoulder has been destroyed or severely injured to such a degree that one cannot hope to secure a return of shoulder-joint motion. The loss of bone is restored by ankylosing the humerus to the scapula by a truss-work

of tibial grafts, usually two in number. During the union of the grafts the arm is immobilized in an elevated anterior posture, and is held in such relation to the scapula that the powerful scapulothoracic muscles which control this bone may later move it. Thus by causing the scapulothoracic motion to compensate for loss of shoulder motion of the arm, the lost motion of the arm and shoulder is restored to a surprising degree.

Restoration of the shaft of the humerus, femur, tibia or any long, large bone has been accomplished by means of a graft inlaid by the author's usual inlay technic. On bones of the forearm, or on any bone of small diameter, or in cases in which a bone of large diameter has become conical-ended, the mode of repair resorted to is designated for purpose of description, as the "fishpole." technic, since a similar method is employed by the artisan in mending a fishpole.

The influence of stress on the hypertrophy and metabolism of bone has been more strikingly illustrated in bone graft restoration of the shafts of long bones than in any similar class of work. However small the diameter of the graft, provided it be protected from fracture by external support and at the same time be allowed to withstand stress, it will eventually restore the lost bone in almost anatomic particular, namely, in diameter, strength and external contour, as well as in respect to the internal architecture.

By making the most of all known mechanical joints and by the insertion of kangaroo tendon in such a way as to afford the best internal fixation, in conjunction with the most perfect external fixation by plaster-of-Paris dressings, the extremity being placed in various "positions of neutral muscle-pull" immobilization of the involved fragment has been found possible. Too great emphasis cannot be laid on the importance of putting absorbable ligatures in the skin, so that carefully applied Plaster-of-Paris dressings need not be disturbed for a period of at least eight weeks after implantation of the graft. Plain catgut No. 0 or No. 1 with suture-holes puddled with tincture of iodine, serves admirably for this purpose. Chromic catgut No. 0 or No. 1 is also suitable. The buried sutures in the soft parts should always be small in diameter and as limited in number as possible. The only adequate postoperative dressing in these cases is the plaster-of-Paris splint, applied with the utmost care and molded to the bony contours of the extremity. It should always include at least one joint above and one joint below the bone involved, with due attention given to position, which is of the greatest importance.

SYNTHETIC GRAFTING OF TISSUES IN CONSTRUCTION OF NEW FINGERS.

In two cases of loss of four fingers with the adjoining metacarpal bones as a result of high explosive shell and shrapnel wounds, the hands were completely helpless, so far as grasping and holding were concerned. Function has been restored to a great extent by the synthetic construction of new digits. By providing an opposing surface to the thumb, the usefulness of the member has in each instance been restored.

In plastic work of this nature, which involves the transplantation of more than one kind of tissue, a two-step or multiple-step procedure is the only method whereby a successful sequence may be expected. It is essential in handling soft parts and bone that the skin and subcutaneous tissues be firmly united with the host tissue and that circulation be well established before implantation

of bone. Ease of technic and the possibility of obtaining ample soft tissues and bone have also led the author to recommend strongly this type of operative procedure.

Relief of Compression Fracture of the Vertebrae.—The use of the bone graft as a means for relief of compression fractures of the vertebral bodies has afforded satisfactory results. On account of meager bone growth and inadequate bone repair around crushed vertebral bodies, and because of constant interference with bony union by the respiratory and voluntary motion, nature, unassisted, does not bring about the proper repair in these cases, even though efficient external means of immobilization be employed for months, sometimes even for years. To supply the deficiency resulting from lack of bone repair, the bone graft offers a sure means of relief and its indications in such cases are as definite as in any pathological or traumatic condition encountered.—*Leo C. Donnelly, Detroit.*

A Case of Bi-Lateral Recurrent Paralysis of the Musculo-Spiral Nerve. V. Putti. *La Chirurgia degli organi di movimento*, February, 1920.

The author reports extensively the history of a girl of 13 years of age who had been a patient at the Istituto Rizzoli for the last four years. She reported first with complete paralysis of the right musculo-spiral nerve, the triceps alone responding normally to electric examination. The arm showed a small reddish speck on the outside resembling a suffusion and an open operation was done which consisted in cutting down upon the musculo-spiral nerve between the middle and lower third of the humerus. It was found that a bluish spot existed underneath the sheath of the nerve together with some induration of the nerve structure. The tract of the injured nerve was encased in the sheath and artery prepared according to Faramitti.

The most amazing thing was the persistent recurrence of the paralysis after apparently completely cured, and the appearance of the same paralysis on the left side. From October, 1913, to the present time, which is within 6 years, the musculo-spiral nerve of the right side was paralyzed four times, that of the left side three times. When last seen the musculo-spiral nerve of both sides was paralyzed. There were also some important nutritive changes noticed, especially in the latter part of observation. The fingers of both hands were the seat of numerous congelations which were partly ulcerated. There was also on the right side a torpid, secreting spot which had appeared without apparent cause. Galvanic and faradic excitability were lost in muscles as well as nerves.—*A. Steindler, Iowa City, Ia.*

The Reconstruction of the Crucial Ligaments of the Knee. V. Putti. *La Chirurgia degli organi di movimento*, February, 1920.

Cases of arthroplasty are not uncommon in which the lack of crucial ligaments, sacrificed during the operation, interferes greatly with the stability of the knee. The author had occasion to find this instability of the knee joint

repeatedly after arthroplasty. He has tried for sometime to remedy the defect by a reconstruction of the crucial ligament.

He reports two cases of this kind.

The first case was that of a boy 14 years in which the knee had ankylosed in a position of 110 degrees flexion following a severe articular infection. The especially favorable condition called for arthroplasty even in a patient as young as this but following the operation instability of the knee caused the author to undertake the operation for reconstruction of the crucial ligaments. This was done by means of a tunnel drilled from the external and posterior part of the external condyle of the femur to the antero-internal part of the condyle of the tibia paralleling the course of the anterior crucial ligament. Into this bone a piece of tendon, mobilized from the semitendonosis was introduced and fastened with silk to the tibia and femur.

The post operative result was satisfactory but active mobilization was not insisted upon because the patient developed a hyper-sensitiveness to motion. Nevertheless, he gained a good deal of stability in the knee joint.

The result of the second case was even more striking. It concerned a Captain with ankylosis of the knee following shrapnel wound on whom an arthroplasty of the knee was performed with free flap interposition. He showed subsequently a certain degree of antero-posterior motion of the knee although the functional result of the arthroplasty was satisfactory, as it amounted to a range of motion of 90 degrees. The reconstruction of the anterior crucial ligament was carried out in a similar way except that a small screw was used to fasten to the end of the tendon.

Five months after operation the condition of the joint was as follows:

Active flexion 60 degrees, extension complete, moveable patella, well functionating quadriceps. All signs of lateral motion and of sagittal motion had disappeared.

This operation, therefore fulfilled its purpose. Refering to an operation carried out for the same purpose by Hey-Groves, the author believes that his operation is incomplete and will obtain its object only in cases in which there is an isolated lesion of the crucial ligament. The author also considers seriously the advisability of reconstructing the lateral ligaments of the knee in a similar manner, namely, by free tendon attached to the condyles of the femur and tibia on either side of the knee.—*A. Steindler, Iowa City, Ia.*

The End Results in Partial Amputations of the Foot. S. T. Irwin, Belfast. *British Journal of Surgery*, January, 1920.

These observations are the result of experience during work in the Limbless Department of the Ulster Volunteer Force Hospital, Belfast. The author has been particularly struck by the difficulties in fitting cases of partial amputation of the foot; by the apparent impossibility of giving such patients even a moderately useful appliance; and by the frequent necessity for repairs and readjustment.

In regard to amputation of the toes he says it is always advisable to retain the great toe, if possible, and it is better surgery to excise a joint, in hammer

toe for instance and to otherwise relieve painful conditions, than to amputate even in the four outer toes. Operations for hallux valgus and hallux rigidus, though giving excellent results in civil practice, were disappointing when done for a soldier. A tender scar over the metatarsal head in amputation of the great toe often caused spasmodic inversion of the foot and prolonged disability.

Of all amputations in the lower limb none give more disappointing results, in regard to function, than partial amputations of the foot. They should never be done as a definite operation where limb fitting and suitability for employment are the determining factors in the choice of operation. The main objection is the shortening of the anterior pillar of the antero-posterior arch and the consequent results which are loss of muscular equilibrium producing deformities of equinus and varus. Difficulty is also found in supplying suitable appliances for such amputations. The elaborate fittings invented in France and Germany, according to the English author, have been uniformly unsuccessful. In Lisfranc's operation the weight is born on the outer border of the foot, the inner edge held up mainly by action of the tibialis anticus which stands out as a rigid cord drawing the cuboid inwards. The foot becomes painful in walking and rigid from spastic contraction of the tibial and peroneal muscles. The os calcis finally becomes drawn up and the weight bearing cuboid has a painful bunion overlying it. In Chopart's amputation the functional result is not as good as in Lisfranc's. After walking or standing the ankle joint first becomes painful and because there are no anterior muscular attachments the front of the os calcis and head of the astragalus rotate downwards carrying with them the scar which eventually becomes the bearing surface directly under the ankle joint the heel being drawn up behind. These secondary disabilities and deformities resulting from partial amputations are better corrected by completely amputating the foot than by corrective measures such as cutting the tendo Achilles, fixation of extensor tendons or ankylosis of the ankle.

Of the various operations and modifications of the operations through the ankle joint the author is most enthusiastic over that of Syme. From the functional standpoint he places it even higher in the scale than that of Lisfranc or an amputation at the junction of the middle and lower third of the leg which he says indicates that the ideal performance of this operation (Syme) leaves a stump which is, from the point of view of function, as nearly perfect as possible. It gives a complete and permanent bearing; there is a long lever for the activation of the artificial limb and the provision of perfect stability; and the presence of the natural knee gives almost, if not indeed quite, perfect gait. His only criticism is that the artificial ankle, owing to the side bars, is rather bulky.

A graphic representation of capacity for work in partial amputations of the foot is a valuable feature of the paper.—*E. E. Hobley, Iowa City.*

THE USE OF BEEF-BONE SCREWS IN FRACTURES AND BONE TRANSPLANTATION. By M. S. Henderson, M. D., Rochester, Minn. *The Journal A. M. A.*, Vol. 74, No. 11, March 13, 1920.

Bone grafting has become established in surgical practice as firmly as the more simple operation of skin grafting, and it has been found that the auto-

genous graft is the best. Practically all failures can be definitely attributed to technical errors, such as too small a graft, infection or inadequate fixed bony approximation of the graft to the fragments.

From a purely theoretical point of view, screws made from the bone of the patient, such as the bone pegs advocated by Albee, would be better than beef-bone screws. The theory, when put into practice has so many objections, such as making the screws or pegs fit properly, and the extra amount of bone used, that beef-bone screws are to be preferred. The question of whether the beef bone is suitable for a graft does not enter into this discussion, for all that is demanded of the screws is that they provide fixation of the autogenous graft to the fragments. They are usually absorbed completely within six months to a year.

Fresh beef bone is obtained usually from the tibia, the joint ends are sawed off, and the shaft is boiled for 1½ hours to remove the tissue and the marrow. The shaft is sawed into pieces 3¾, 2⅜ and 1¼ inches long for the large, medium and small size of screws, respectively. The medium sized screw is of aid in many situations, and many more of these are used than of either the large or the small screws. The sizes used are standard, and in mechanical terms the large screws are known as 5/16 by 18, the medium size as 10 by 24, and the small as 6 by 32. The lengths adopted are arbitrary and may be varied to suit the needs of the case. The pieces are sawed lengthwise into strips; the width varies according to the diameter of the screw to be made. The strips are roughly sized in the vise by filing, and are then turned to the proper size, pointed, and the head rounded in the lathe. These finished blanks are placed, for one half hour in petrolatum brought to the melting point in a double boiler, in order to replace to some extent the natural oils removed by the boiling. This renders the bone a little less brittle and less likely to crumble when being threaded. The heat must not be extreme or the bone will be overheated and rendered almost chalky.

The blanks are placed in the lathe and threaded by using a standard machine screw die. Petrolatum is freely used on the die while the threads are being cut. The large blank is threaded with a standard 5/16 inch by 18 die. The thread is 5/16 inch long and is flattened on two sides to ¼ inch in thickness to fit a special wrench. The large screw when finished is ordinarily 3½ inches long, but this may be varied. The medium sized blank is finished into a screw 19/100 inch in diameter and 2¼ inches in length. A little more care is necessary in putting the threads on this size than on the large screw, and we have found it necessary to step down the threads by using three dies: 12 by 24, 11 by 24, and 10 by 24. The small blank is for a screw 14/100 inch in diameter and 1⅛ inches long. It is necessary to step down the threads for this screw as follows: 8 by 32, 7 by 32 to 6 by 32. The heads of the two smaller screws are ¼ inch long and ¼ inch in diameter to allow for hexagonal shaping to a 3/16 inch standard. These fit a specially made socket wrench fitted to the end of a small brace. When the screws are received from the machine shop they are thoroughly scrubbed with soap and water and boiled in water for thirty minutes. They are then kept in the instrument case and boiled as required, just as any instrument is boiled. The screws are cheap, easily made and well tolerated by bone. The

one objection to them is that they are brittle and will not withstand any amount of stress, particularly if there is any torsion with the strain.

Even though the beef-bone screws are well made, they cannot be successfully used unless there are at hand the proper instruments for placing them. It must be remembered that they will withstand very little twisting force, and if they bind when being screwed in they will break. For the large size, 5/16 by 18, a special socket wrench is used. The large screws are used only in situations such as the head of the femur or the condyle of the femur. If not passed through any cortical bone, they are of sufficient strength to make their own threads in the soft bone, and the drill hole bored by a 9/32 inch twist drill does not need to be tapped. Since the medium sized screws, 10 by 24, and the small screws, 6 by 32, have a hexagonal head of the same size, the same wrench fits the two. For the medium sized screw the holes in the graft and fragment are bored by No. 17 twist drill and the hole is tapped by a 10/24 tap. For the small screw the hole is drilled by a No. 29 twist drill and the hole tapped by a 6/32 tap. The drill can be used on the electric motor or the hand drill. The tapping must be carefully done by hand. Handles of different styles for the wrench and taps will be found convenient for the different situations. If the subcutaneous structures are scanty, the heads of the bone screws may be removed either by bone-biting forceps or a Gigli saw.

In recent spiral or oblique fractures of the long bones, recent fractures of the neck of the femur, of the olecranon process and in certain fractures of the patella, the screws are an excellent means of obtaining coaptation of the fragments. They are a splendid means of fastening the bone grafts to the spinous processes, as is necessary in the operation advanced by Albee for tuberculosis of the spine, and are apparently the only means by which proper bony approximation can be assured. They are not so ideal in delayed union or for ununited fractures. In fractures of these two groups, it is better to accept no compromise but to employ a large graft so that when the operation is completed there is from 20 to 25 per cent. more bone in the fractured region than is normal.

If the roentgen ray discloses very marked oseoporosis of the fragments, exercises should be instituted prior to operation, regardless of the fracture, because it is only by this means that the osteoporosis will be overcome.

The technic of the inlay graft will not permit the placing of a very broad piece in the fragments. On account of failure and accidents with the ordinary intramedullary and inlay grafts, and the belief that it is most important to place more bone in the fractured area than is normally there, it has been the author's custom to proceed as follows:

The bond ends are carefully freshened so that as broad an area of their surface as possible will be in firm contact. The medullary cavity in each fragment should be opened. From one fifth to one-fourth of the entire thickness of the bone from each fragment on one side is removed for a goodly distance above and below the fracture. This should not remove the entire cortical wall. The graft, which is a piece of healthy bone from the tibia or the entire thickness of the fibula, flattened on one side, is greater in thickness than the amount of bone removed from the fragments, and is placed against their freshened surfaces, the ends of which are firm apposition and the medullary cavities in line. It is held in place by two or more beef-bone screws through the graft and through the

remains of the proximal cortex and the opposite cortex of each fragment.—*Leo. C. Donnelly, Detroit.*

FRACTURES OF THE PELVIS. William John Ryan, M. D., Philadelphia. *Annals of Surgery*, March, 1920.

The author reports 25 cases and he cites 202 cases collected from the literature. He says this serious injury is much more common than generally supposed. From the mechanical and anatomical standpoint the configuration of the pelvic ring is weakest at five points, viz: at or a little external to the sacro-ilias synchondrosis; at the symphisis pubis; and midway between the symphisis pubis and the acetabulum.

Clinical effects of fractures are considered with reference to the various functions of the pelvis which are: 1. Weight bearing between the vertebral column and the lower extremity.

2. A means of providing motion of the trunk on the lower limbs and affording attachment of muscles governing such motion.

3. A bony attachment for the abdominal and pelvic viscera.

Morris in Piersol's Anatomy is referred to in describing the mechanics of the various arches of the pelvis as explaining why severe direct violence applied to the pelvis will result in fracture of the horizontal or descending rami of the pubis, the rami of the ischium, and of the ilia external to the sacro-iliac joint.

In the author's series of 25 cases there were seven deaths, a mortality of 28%. The cases which died had severe complicating injuries. There were 13 cases of fracture of the pubis, eight of the ilium, one of the body of the right ischium, one of the body of the left ischium, one of both tuber ischii, and one of the anterior superior spine.

The most common symptom was pain increased by pressure exerted simultaneously on both hips. Crepitus was noted three times but should not be looked for. Always catheterize; if bloody urine is found determine whether rupture of urethra or rupture of bladder. Meet the operative indications found. If the fracture is one of the ilium with or without sacro-iliac joint involvement a plaster cast should be applied around the pelvis. If pubis or ischium is involved a wide adhesive swathe is used. In either case a Bradford frame elevated above the bed for facility of affording attention is indicated.

Of the cases that recovered 11 were traced at the end of a year or more. Seven were normal, one had normal function but occasional pains in the region of the sacrum; 1 had a limp due to shortening of limb fractured at same time as pelvic fracture; one had vague pains through the pelvis though examination was negative; one who had a possible rupture of urethra also had an enlarged prostate accounting for symptoms, improved under treatment and drifted from observation.—*E. E. Hobly, Iowa City.*

ADEQUATE REDUCTION AND CARE IN COLLE'S FRACTURE. NEW METHODS. Frederick J. Cotton, Boston. *Boston Medical and Surgical Journal*, December 4, 1919.

The main cause for unsatisfactory results in the reduction of Colle's fracture is the backward rocking of the distal fragment, which makes proper reduction

of the ulna impossible, which luxation, rather than the fracture of the radius, is the cause of the disability. When the wrist is broken, there is a rotation backward of the hand about the ulnar head as a fixed point, and which tears the ulnar ligaments loose and also breaks the radius and gives the altered angle of the articulating surfaces.

If the hand is displaced in extension, reduce it in flexion, or if it is displaced in rotation-supination about the ulnar head, reduce it in pronation. The whole point is—after the obvious displacement of the radius is corrected, then carry the hand about the ulnar head as a fixed point into pronation and flexion. In the old cases osteotomy is done and the procedure followed as in a fresh case.—*Custis Lee Hall, Washington, D. C.*

CONGENITAL SYPHILIS IN AN ORTHOPAEDIC CLINIC. P. W. Roberts, M. D. *The American Journal of Syphilis*, October, 1919.

The author reports a series of 226 cases which he considered to be congenital syphilis and which had been diagnosed as follows:

Eighty-one cases of Joint Tuberculosis, 14 cases as Osteomyelitis of the bones, 5 cases as Torticollis, 12 cases as Myotonia, 5 cases as Tuberculous Adenitis, 7 cases as Myositis with sacro-iliac strain, 24 cases as Arthritis, 8 cases as disease of the carpus or tarsus, 16 cases as Chronic Headache, 10 cases as Osteochrondritis of the Hip, 1 case as Lateral Curvature of the Spine, 1 case as Lymphangitis.

Of the 81 joint cases Wasserman test was made in 47 showing 11 weakly positive and 36 negative result with alcoholic extracts. With cholesterinized antigens, however, they tested 33 positive from 1 plus to 4 plus and 14 negatives.

While the author does not assert that these cases were syphilis he maintains that they present some evidence of inherited taint and they all responded to anti-luetic therapy. The most interesting results were those obtained in lesions of the spine and which before had been diagnosed as tuberculosis of the spine.

All these cases showed perceptible improvement in from 2 to 3 weeks and most of the cases where large articulations were infected became free from symptoms in 2 to 6 months. The author does not consider that disappearance of symptoms is tantamount to cure but proceeds to continue the treatment for at least a year after all evidence of active disease has ceased.

It is the contention of the author that he has demonstrated by this study that chronic articular lesions due to invasion by either tubercle bacilli or by trepanoma pallida produce the same clinical picture. He also emphasizes the necessity of eliminating the diagnosis of congenital syphilis by at least five to six weeks of vigorous anti-luetic treatment.

Of special interest is the author's series of 14 cases of osteomyelitis. In one of these cases, which had been operated four times during a period of six years,

the symptoms all disappeared and the sinus healed after six weeks of mixed treatment. Other cases showed similar improvement.

He also takes up the group cf osteochrondritis of the hip, known as Legg Perthe's disease. Not only was there rapid subsidence of acute symptoms but of eight bloods tested with cholesterinized antigents, one gave 4 plus reaction, one 3 plus, two 2 plus and three 1 plus.

It is the conclusion of the author that many of the syphilic infections pass unrecognized because of the traditional diagnosis of tuberculosis in almost all destructive lesions of the spine and large joints.—*A. Steindler, Iowa City, Iowa.*

THE TREATMENT OF CENTRAL LUXATION OF THE FEMUR. By Royal Whitman, M. D., New York, N. Y. *Annals of Surgery*, Vol. LXXI, January, 1920, No. 1.

This paper is practically limited to the consideration of fracture of the base of the acetabulum with penetration of the femoral head, uncomplicated by extensive fracture of the pelvis or injury of its contents; in other words, to the class of cases in which the chief concern is the functional result as affected by treatment.

The prominence of the trochanter is lost. The limb is somewhat flexed, adducted, and slightly shortened. There is a fair range of flexion and extension, but rotation is very limited, and abduction is almost completely restricted because of the contact of the trochanter with the acetabular rim.

When weight bearing is attempted, pain is increased and is reflected down the inner and posterior region of the thigh, caused apparently by pressure on the nerves passing in the neighborhood of the displaced femoral head.

The practical indication in treatment is to assure a sufficient range of a abduction, which from the functional standpoint is of far greater importance than the reduction of the dislocation although the one is necessarily dependent upon the other.

The head of the femur having been driven inward, the trochanter is apposed to the acetabular rim when the limb is in the line of the body. This furnishes a point of resistance or fulcrum against which the leverage of the extended limb may be utilized to withdraw the head of the femur from the pelvis.

The patient, having been anaesthetized, is placed on a pelvic support, provided with a perineal bar. The sound limb is then abducted to the normal limit to fix the pelvis. The other limb in the extended attitude and under manual traction is then gradually and forcibly abducted, if practicable, to the normal limit, which should indicate the complete withdrawal of the head from the pelvis, and in this attitude a plaster spica is applied extending from the line of the nipples to the knee.

It is possible, if the patient were treated soon after the injury, that the displaced acetabular floor might be reduced somewhat by pressure through the vagina or rectum. The plaster spica must be retained for several months, locomotion being permitted as soon as it does not increase the discomfort, since displacement is impossible in the abducted attitude. After the support is removed, the limb must be passively abducted to the full limit at frequent intervals, until the patient has regained voluntary control of this movement.

This treatment is designed primarily for uncomplicated cases, in which natural mechanics may be utilized. If the pelvis were so fractured that effective leverage could not be employed because of the lack of a resistant fulcrum, one would attempt to secure a sufficient degree of abduction by direct manual traction combined with gentle lateral movement of the limb.

The range of abduction is dependent upon the distance between the trochanter and the acetabular rim, and it is determined by their apposition. Complete abduction indicates complete disengagement of the head; and a limited range a corresponding incompleteness of reduction.

If the resistance has become so great that the head cannot be withdrawn by natural leverage, an osteotomy below the trochanter is indicated, since the purpose of treatment is to secure and to retain a sufficient range of abduction for functional requirements.

Intrapelvic exploration would seem to be a doubtful expedient. In recent cases the displacement should be easily reduced by the abduction method, while if of long standing the prospect of improved function would hardly justify the risk.

If a sufficient range of abduction is attained by the manipulation its retention can be assured by fixing the limb for a sufficient time to permit the accommodative changes in the tissues. This time should vary with the duration of the displacement, and the quality of the after-treatment at command, and fixation should again be employed if the range of abduction progressively lessens.

This latest application of the principles of the abduction treatment illustrates its wide range of practical adaptability. Nearly all of the so called disabling contusions about the hip are in reality fractures of the femur or of the pelvis, and either because of uncorrected deformity or as an instinctive adaptation to weakness and pain, the limb usually becomes flexed and adducted.

In all obscure injuries in this region, the abduction method might be applied with advantage as for fracture of the neck of the femur since it is the only efficient means of adjusting and fixing the fragments if thus broken, while if the pelvis is injured, restraint of the limb is required for effective splinting. The abduction treatment has the further advantage that immediate correction of deformity, the first essential of success, is supplemented by an after care conducted with a definite aim and guided by physical signs that indicate the progress of reconstruction upon which functional recovery depends.—*Leo C. Donnelly, Detroit.*

Stiff Knee in Relation to Compound Fracture of Femur. Paul Bernard Roth. *B. M. J.*, 1919, Vol. 3064, p. 395.

In commenting on the article by Captain Alexander, issue is taken by the writer to the point that stiff knee resulting from compound fracture of the femur is due to shortening of the quadriceps and adhesions resulting from disuse and sepsis. It is Roth's belief that stiff knee is due to the method of treatment. He asserts that if treated with a straight Thomas splint the stiffness may result as Capt. Alexander explains: that, however, if a modified Thomas splint be used, with the added lower half of a Watkins-Williams and

extension applied direct to the fragment by means of Pearson tongs, the knee may be flexed and the quadriceps exercised daily. With this latter procedure he regards the occasion of a stiff knee resulting to be a disgrace to the surgeon.

He further takes exception to the statement that all compound fractures of the femur cause knee infection, and questions how it would be possible for this to occur in the case of compound fracture in the upper third of the femur.

Mr. Roth prefers chloroform or ether to gas, as more thorough relaxation may be obtained and there is less danger of damage to quadriceps and knee-ligaments in wrenching of the knee.—*J. E. M. Thomson, Lincoln.*

FURTHER OBSERVATIONS ON THE CONSERVATIVE TREATMENT OF SARCOMA OF THE LONG BONES. William B. Coley, New York. *Annals of Surgery*, December, 1919.

Certain considerations of the condition, following a study of 250 cases, with conservative measures in view, convince the author that radical surgical procedures, such as amputations, are often unnecessary. First the element of pain of a deep boring character, steadily increasing in severity, is the earliest symptom of the disease. In case of doubt the exploratory operation is advised, but the clinical course and X-ray picture render diagnosis practically certain. The author believes operation for diagnostic purposes does not cause any great degree of risk of metastases. Difficulty is encountered in establishing a definite diagnosis between giant cell sarcoma of the non-malignant type and the malignant forms of sarcoma. In forty cases of supposed giant cell sarcoma, eight cases died of metastases.

In dealing with periosteal tumors the treatment is of course, radical, even prompt amputation very early in the disease has failed to prevent fatal termination. A plea is made for conservative treatment even in this type and the use of radium locally, sometimes placed in the operative wound next the bone, and the toxin treatment, consisting of mixed toxins of erysipelas and bacillus prodigiosus. Giant cell sarcoma of the long bones, the author believes, is more rare than is usually supposed. In this series of cases it has been found possible to save the limb in 17 cases by the use of toxins alone 4 by a combination of toxin and radium treatment, 2 by curetting. Of the 17 cases in which the limb was saved, 6 were of periosteal origin and 12 of central origin. An excellent article with splendid case reports and illustrations.—*Custis Lee Hall, Washington, D. C.*

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The Journal of Orthopaedic Surgery

A SPLINT FOR TREATMENT OF STIFF FINGERS

By Major F. F. A. Ulrich, N. Z. M. C.
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Doubtless one of the worst bugbears which confronts the Military Orthopaedic Surgeons is stiffness of the metacarpo-phalangeal and inter-phalangeal joints. For this reason I venture to describe a splint which we have found useful in N. Z. Orthopaedic Hospitals.

Various surgeons have written on this subject and a few have described most useful splints for its treatment.

This disability may follow a number of causes which have already been detailed by several writers, especially Mr. Verrall in his excellent article in the June number of The Journal of Orthopaedic Surgery.

Among the various splints which have been used at this hospital, are the Verrall, the Langworthy, the Lewis, the Brockenhurst and so on.

Now in most of these splints with the possible exception of the Lewis splint, the necessary counter-traction is entrusted to the splint encircling the wrist tightly and so abutting against the radial and ulna borders of the hand i. e. the bases of the first and fifth metacarpal bones. Our experience here has been that no matter how tightly these splints are applied there is always some "give" towards the extremity of the limb with the result that there is some loss of dorsi-flexion of the wrist joint and so a distinct loss in our attempt to gain flexion of the finger joints. It was to obviate this that the writer improvised the variety of splint described in this article.

The *Splint,* which for a better name we have called the Finger Flexion Splint, is used solely to gain flexion at the metacarpo-phalangeal and inter-phalangeal joints of patients whose fingers are stiff in an extended or partly extended position and whose wrist joints may be normal or can at least be dorsi-flexed to a useful degree as nearly as possible approximating the position of physiological rest.

So many cases of stiff fingers are associated with stiffness of the wrist joint that in describing this splint it is impossible to dissociate the two conditions as the splint can be used in those cases only which have a useful degree of dorsi-flexion of the wrist joint. This point is essential.

The preparation of the wrist joint is a necessary preliminary. If it will not dorsi-flex it must be forced either by wrenching or operation or both and a reasonable time given for discomfort in the joint to settle down, preferably in Plaster of Paris. It may be necessary to wrench the finger joints at the time of wrenching the wrist joint to gain a little flexion of these joints or a fist plaster may be applied for a very limited time, but this should be avoided if possible and is seldom necessary as almost invariably the dorsi-flexion of the wrist joint at once permits of a limited but working degree of flexion of the fingers, especially the metacarpo-phalangeal joints.

It is taken for granted that all necessary operative procedures on bone, tendon and skin, etc., have been completed.

The Splint is made of 3/16″ mild steel and is fashioned to fit across the palm of the hand opposite the metacarpal necks, curved to retain the arch of the hand as much as possible. It is now bent along the ulna and radial borders of the hand and forearm, passing between the thumb and index finger and kinked forwards at the wrist to follow the contour of the dorsi-flexed wrist joint. The palmar bar of the splint is neatly fitted with rubber tubing but probably any soft tissue would do. The ends of the splint are hooked and terminate about three-fourths of distance up the forearm. Usually a roughened metal strut is welded to the limbs of splint near the hooked ends to facilitate firm incorporation in Plaster of Paris.

The *principle* of the Splint is retention of wrist in a constant degree of dorsi-flexion while flexion of fingers is gained by tape

and glue applied to their dorsal surfaces. The writer first used this method at Alder Hey almost two years ago and has had no reason to relinquish it.

The Splint is retained in position by Plaster of Paris applied to upper part of forearm and elbow—elbow joint being flexed to 90°.

Figure 1 shows the splint in process of application.

Counter-traction is gained by plaster bandage passing firmly from hook to hook of splint over a square of felt placed over back of arm above elbow. The plaster is applied over cotton wool in the orthodox Hammersmith method and is cut away from surface of elbow which patients find useful and which makes splint lighter.

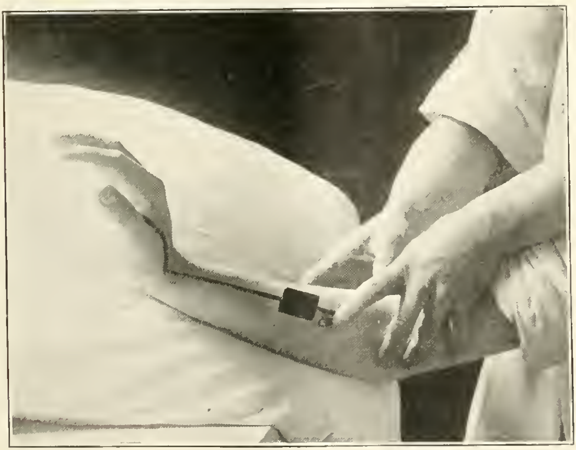


Fig. 1.

One-half inch tape is now fixed by Sinclair's glue to dorsal surfaces of fingers, stopping short at metacarpophalangeal knuckles. If tape is slightly cut transversely over center of inter-phalangeal joints flexion is facilitated and reapplication of the tape is deferred.

For the Traction usually the ends of a short loop of strong bandage are glued to the plaster with loop loose over flexor sur-

face, or occasionally a broad loop of the steel (Fig. II) is incorporated in the flexor surface of the plaster.

The plaster may extend almost to the wrist joint or only a limited way down the forearm, depending on necessity or otherwise of electric and other treatment to muscles of forearm.

In some very flexible wrists or in some wrists with limited dorsi-flexion it is sometimes necessary to buckle a strip of webbing across dorsum of wrist from limb to limb of splint as occasionally patient can undo his dorsi-flexion.

Procedure: The plaster and glue having dried for 24 hours flexion of fingers may be commenced by noosing the 4 tapes through the flexion loop as firmly as patient can bear it.

The flexion is divided into two stages:

1. Flexion of metacarpo-phalangeal and first inter-phalangeal joints. This is continued until pads of fingers approximate the thenar and hypothenar eminences (Fig. II).

2. Flexion of first and second inter-phalangeal joints.

Fig. II.

This is gained by passing the tapes between the palmar bar and the palm and applying traction as before. The mild pressure of tapes on base of hand has never caused any inconvenience (Fig. III).

These two stages of flexion of course merge into one another. *Treatment* consists of a daily visit to Physiotherapeutic Department where tapes are united, fingers energised in every way, massage and re-education, and if neecssary graduated faradism applied

Fig. III.

to muscles of forearm and intrinsic muscles of the hand. In most cases patients are also instructed to untie tapes and perform active movements of fingers twice daily.

Tapes are tightened from day to day and when first stage of flexion is attained surgeon must decide whether the splint should be removed and patient return to full treatment in Physiotherapy Department with some mild gymnasium, as graduated grips, or should go on to the second stage of flexion.

In a considerable number of cases it is found that the mechanical part of the treatment outstrips the physiotherapeutic part with

the result that the passive flexion gained is further advanced than the active flexion.

In other cases, especially those where the inactive tissues are specially at fault, a limited degree of extension is lost but this readily returns under treatment in Massage Department, after removal of splint.

Again in a few cases after removal of splint a limited degree of the flexion gained is lost; this is especially so in those cases where our traction treatment has outstripped that of the Physiotherapeutist.

The Splint is usually kept on 1, 2, or 3 weeks, and a further application may be necessary after a week or two treatment in the Massage Department.

The Splint, like all other splints, has its deficiencies, but they are petty and can be neglected when one considers the results gained.

Some advantages claimed for this Splint are:

1. Constant degree of dorsi-flexion.
2. Flexion is painless, continuous and easily graduated in the individual fingers.
3. Flexion is divided into two stages.
4. No impediment to circulation of fingers by encircling bands.
5. Accessibility of hand and greater part of forearm for massage and electric treatment without removal of the Splint.

This last advantage is of greater importance and has made it possible to use the splint in all cases whether traumatic, ischaemic, or functional.

ASTRAGALO-SCAPHOID DISLOCATIONS OF THE FOOT

BY ARCH F. O'DONOGHUE, M. D., IOWA CITY, IOWA.

Report of Five Cases from the Orthopedic Service, Iowa State University College of Medicine

In making a study of this condition which is by no means so rare as a reference to contemporary literature would seem to indicate, it is important to have a thorough understanding of the anatomy of the foot.

Even in the most casual examination of the foot one is struck by the great difference in both ligamentous and muscular support between the plantar and dorsal aspects. On the plantar side are many very strong and firmly anchored fascias. Mesially the calcaneo-navicular, the cuboideo-navicular, the cuneo-navicular, and the tarso-metatarsal ligaments strongly re-enforced by the tendons of the tibialis posticus and flexor longus digitorum muscles, form a bridge with the scaphoid as its keystone that is almost unbreakable; and laterally the heavy tough ligamentum plantare longum with the calcaneo-cuboid and intermetatarsal ligaments supported by the tendon of the peroneus longus form a second firm suspension for the tarsal arch. These supports are so powerful that actual fracture of the tarsal bones or of the external malleolus is as probable as a breaking down of these bands with dislocation and consequent traumatic valgus. The conditions are very different on the dorsum of the foot. Here we find a number of so called ligaments most of them but slightly thickened portions of the articular capsules (the stellate ligaments of Fick) and in no way comparable in strength with the plantar structures, and these are supported by but one small muscle, the peroneus tertius; the extensor digitorum cummunis being here so loosely applied that it really has no supporting action at all. Even with this rather inadequate support dislocation in Chopart's joint is not common, possibly because the peroneus tertius usually exerts a component towards the prevention of varus. This difference in the ligamentous support is also important in the treatment of traumatic foot deformities. In traumatic valgus either with or without fracture, if the deformity is reduced and the foot properly immobilized repair of the lacerated ligaments is so complete that such conservative treatment will usually suffice to bring about satisfactory return of function. This

is not true of traumatic varus for in this condition even though the dislocation be reduced early, it is so hard to maintain that the slightest trauma will effect a redislocation. Thus conservative treatment is usually a failure as it was in three of our cases. Probably the supporting power of even a small muscle like the peroneus tertius is underestimated. It is interesting that in each one of our cases of astragalo-scaphoid dislocation the foot was strongly plantar flexed at the moment of injury and the peroneus tertius being already stretched to its full extent may not have been able to exert its usual restraining action against the occurrence of such deformity.

Fig. I.—Case 1 before operation showng dislocated astragalus.

Report of Cases.

Case 1. Miss F. A. A servant girl, age 22 years. First injured her foot when a baby by "twisting it." She does not know any more details about the injury but she started to walk at the normal age. She states that the foot was somewhat turned in and that she had always limped slightly although she had no pain. Two months ago the patient was riding a horse which fell through a bridge. Her left foot was caught between the timbers of the bridge and the horse's body, being severely injured. She fell forward and to the right forcing the foot into extreme equino varus position. She had very severe pain and was carried home. The next day the foot was much swollen and discolored and still very pain-

Fig. II.—Case 1 after astragalectomy.

ful. Its position at that time was the same as on entrance to the hospital. A doctor was called who applied hot dressings but made no attempt at a reduction. After two months the foot was still so tender that it would bear no weight. The patient comes in for treatment.

Examination on entrance showed the foot to be in extreme varus position. There was no discoloration nor swelling. The head of the astragalus was distinctly palpable on the outer dorsum of the foot. The Tendo-Achilles was moderately contracted. The scap-

hoid could be palpated mesially and there was distinct depression proximal to it. There was no motion in the tarsal joint. The X-ray showed the scaphoid with all of the tarsal bones anterior to it displaced inward with the head of the astragalus lying above and resting upon the cuboid. The astragalus was dislocated antero mesially upon the tibia. There was no evidence of fracture.

Radical correction was determined upon and the patient operated on May 13, 1919. An incision was made arising from the outer malleolus and extending onto the dorsum of the foot over the head of the astragalus. The head and neck of the astragalus were removed, the dislocation reduced, and the wound closed. X-ray two weeks after operation showed the bones of the tarsus to be in their proper relation but the astragalus was dislocated anteriorly upon the tibia. This condition persisted in spite of carefully applied casts so on November 25, 1919, the foot was again opened and the astragalus removed using Whitman's technic. At present, four months after operation, the deformity is completely corrected with almost complete return of function although there is but one-third of the normal range of motion in the tarsal joint. There is one inch shortening.

Case 2. Mr. E. D. Laborer. Age 28 years. Was in an automobile accident 15 weeks ago. Was thrown from the car and fell facing the car with his entire weight on the outer aspect of the right foot. He had immediate severe pain and was taken to a doctor who said the foot was dislocated, attempted to reduce it, and applied a splint. The patient says that the positions of the foot immediately following the injury and on entrance were identical. The foot became much swollen and discolored and was rather painful. The swelling and pain subsided in a couple of weeks but he was unable to place any weight upon it because of tenderness. He comes in for treatment. Patient was first seen on September 23, 1919.

At that time examination showed the foot to be in mild equino varus position. There was no discoloration or swelling. The head of the astragalus was distinctly palpable over the outer dorsum of the foot. Mesially the scaphoid was very prominent and there was a distinct depression proximal to it. No motion in the tarsal joint was possible. The Tendo-Achillis was not contracted. X-ray showed the scaphoid with all the tarsal bones anterior to it dis-

located mesially. The head of the astragalus lay above and rested upon the cuboid. There was no evidence of fracture.

Radical treatment was decided upon and the patient etherized on October 14, 1919. Manual correction was attempted and was unsuccessful. Incision was then made arising from the external malleolus and extending upon the dorsum of the foot over the head of the astragalus. Reduction was again attempted. Failing in this the head and neck of the astragalus were removed, reduction accomplished, periosteal sutures passed between the astragalus and scaphoid, and the wound closed. The foot was dressed in plaster for three months with complete correction of the deformity.

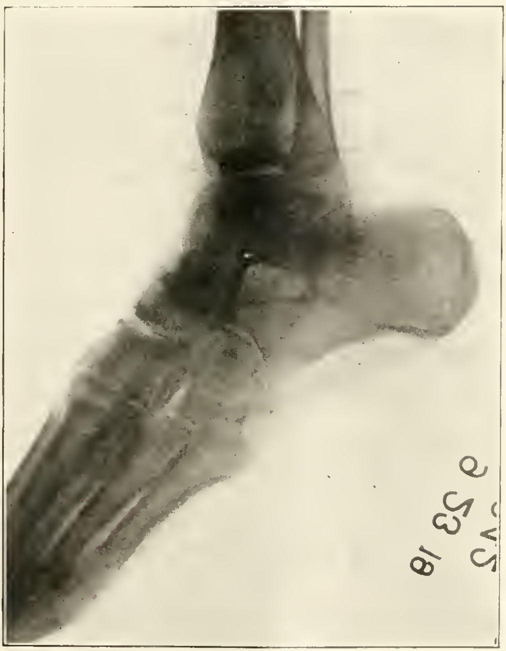


FIG. 111.—Case before operation showing dislocation in astragalo-scaphoid joint.

Massage and baking were then instituted and at present, five months after operation, there is complete return of function and the patient walks without a limp although there is but half the normal range of motion in the tarsal joint. X-ray on discharge shows the tarsal bones to be in their normal relations.

CASE 3. Mr. D. R. B. Farmer. Age 44 years. Was thrown from a horse ten years ago alighting upon the side of his left foot and falling face downward. He had immediate severe pain in his foot which he says was "turned in." A doctor was summoned who straightened the foot out and applied hot dressings. The foot was much swollen and discolored the next day and the pain and swelling persisted for several weeks. The patient was unable to work for six months because of extreme tenderness on weight bearing. From that time until two years ago he has had fair use of his foot although he has repeatedly "turned" it with resulting pain and tenderness on walking for the next few days. Six years ago he obtained a brace which has helped somewhat in stabilizing the foot, but did not hold it firmly enough to prevent injury. For the past two years he has been walking with increasing difficulty and has been unable to work. He comes in for treatment.

He was first seen on September 10, 1919. At that time the foot showed decided varus tendency with some swelling around the external malleolus. There was no discoloration and the Achilles tendon was not contracted. The foot could easily be manipulated into quite extreme varus and when in this position the head of the astragalus was palpable on the outer dorsum of the foot over the cuboid. Mesially the scaphoid was unduly prominent with a marked depression proximal to it. Motion in the tarsal joint was distinctly limited. There was considerable tenderness on weight bearing and the patient walked with a decided limp. X-ray examination with the foot in normal position showed no bone pathology. There was no evidence of fracture.

Radical treatment with suturing of the dislocated bones was advised but the patient wished first to try conservative measures. Accordingly the foot was dressed in plaster in corrected position and the patient discharged. He was seen again two months later. The foot was still very tender on weight bearing and another cast in over correction was applied. One month later the patient was again examined. The foot seemed perfectly corrected when at rest but still showed varus tendency on weight bearing. The tender-

ness was greatly diminished however so he was given a shoe with an outer wedge and an Orr brace with varus strap and discharged for six months. One month later he returned complaining of much pain on walking and another cast was applied. He was last seen February 28, 1920, at which time while the foot seemed completely corrected when at rest it still showed varus tendency and considerable tenderness on weight bearing.

Case 4. Miss M. H. Student. Age 18 years. Was attending a basket ball game on February 2, 1920, when the grandstand collapsed throwing her forward upon her face while her foot was held fast by a fallen plank. She had severe pain in the foot and was immediately taken to the hospital.

Fig. IV.—Case 2 after resection of caput tali.

Examination showed the foot to be in decided varus position and there was already considerable discoloration and swelling. On palpation the head of the astragalus could readily be felt on the outer dorsum of the foot over the cuboid. Mesially the scaphoid could be felt, displaced one inch inward with a distinct depression proximal to it. X-ray examination confirmed the diagnosis of a dislocation of the scapho-astragaloid joint but gave no evidence of fracture. On the next day reduction was easily obtained under gas and the foot dressed in plaster but immediate X-ray examin-

ation through the cast showed the bones slipped out of position. The cast was removed two days later, reduction was again made under anesthesia. Reduction was easy, but very difficult to maintain, the scaphoid slipping out of position with much ease. A plaster dressing was applied. X-ray examination after operation showed the bones to be in place and the patient had considerable relief of pain from the maneuver. The next day, however, she was suffering severe pain and another X-ray showed the luxation to have again occurred. The cast was removed and a week allowed for the swelling to subside. An incision was then made over the scapho astragaloid articulation. The head of the astragalus and the entire

FIG. V.—Case 4 before operation showing luxation in Chopart's joint.

scaphoid were decidedly atrophic and an attempt to drill holes in them for wiring was unsuccessful. The scaphoid therefore was held in position by means of three heavy wire sutures passed through the head of the astragalus. Incision was closed and a plaster dressing applied. An X-ray examination showed the bones to be in proper alignment and a week later, the wound being closed, the patient was discharged. She was seen again one month after operation at which time there was no deformity evident either by manual or X-ray examination. Plaster dressing was applied and the patient discharged.

CASE 5. Master A. R. Schoolboy. Aged 14 years. Injured his right foot one year ago. He was running down a railroad track and caught his foot in a frog. He fell forward and to the left wrenching the foot. He had immediate severe pain and was carried home by his playmates. A doctor was called who diagnosed a sprain, applied a tight bandage, and advised the patient to stay in bed two weeks. The foot did not swell or become discolored and

FIG. VI.—Case 4 after operation.

after a few days he started to use it although the pain forced him to limp considerably. At the end of a month the foot seemed normal, when he again "turned it." This has happened with increasing frequency since that time and for the past month he has scarcely been able to walk at all with his boot off because of the tendency to turn his foot. Comes in for treatment.

He was first seen on March 6, 1920. At this time the foot appeared normal on inspection when at rest. There was no swelling or discoloration. When asked to walk however, he showed a decided limp with tendency to varus and the toes were strongly hyperextended whenever weight bearing was attempted. On manipulation the foot easily went into varus position and when in

FIG. VII—Case 5 before operation.

this position the head of the astragalus could be palpated on the outer dorsum of the foot lying over the cuboid. The scaphoid could be palpated mesially with a distinct depression proximal to it. X-ray affirmed diagnosis of habitual dislocation in the scapho-astragaloid joint. Radical treatment was advised.

The patient was operated March 13, 1920. An incision was made arising from the outer malleolus and extending up over the dorsum of the foot above the head of the astragalus. Extensor tendons were retracted and the head of the astragalus was firmly

anchored to the scaphoid by heavy periosteal sutures. The torn talo-navicular ligament was then repaired and the wound closed. The foot was dressed in plaster in valgus position. X-ray after operation showed the bones of the tarsus to be in normal alignment.

It will be noticed in each of the above cases that at the moment of injury the foot was strongly dorsi flexed and the peroneus tertius being already stretched to its full extent was unable to exert a component to prevent the occurrence of varus. This margin of safety being absent the deformity was only guarded against by the dorsal interosseus ligaments which proved unequal to the strain. It will further be seen that the dislocation was always in Chopart's joint which is the weakest link in the entire chain, being protected dorsally only by the dorsal scapho-astragaloid ligaments. In all these cases examination showed the head of the astragalus palpable on the outer dorsum, the scaphoid unduly prominent mesially, and with a distinct depression proximal to it. In no one of this series was there evidence of fracture.

In cases 3, 4 and 5 in which conservative treatment was tried it proved ineffectual. Case 3 has been under conservative treatment for almost seven months with practically no improvement in the stability of the foot, and in cases 4 and 5 radical measures had to be employed because of the repeated failure of conservative ones.

In cases 1 and 2 where open operation was done and in which sufficient time has elapsed to show a result the reduction seems permanent and the return of function adequate. And in cases 4 and 5 in which open operation was resorted to when it was determined that reduction could not be maintained otherwise the correction seems satisfactory although of course not enough time has passed to make a positive statement.

In case 5 it was very interesting to see the marked reflex contraction of the extensor communis digitorum in its effort to prevent varus on weight bearing, illustrating again the importance of muscular action in the maintenance of equilibrium in the foot.

Conclusions.

1. Scapho-astragaloid dislocations usually take place when the foot is supinated and plantar-flexed.

2. A palpable caput tali and a prominent scaphoid with a depression proximal to it is the most important physical sign of dislocation in the scapho-astragaloid joint.

3. Open operation is usually indicated in order to hold a satisfactory reduction.

4. Resection of the head of the astragalus is often necessary in cases of more than two weeks standing.

I gratefully acknowledge the co-operation of Dr. A. Steindler in whose clinic these cases were observed and treated and whose help has made their study possible.

TREATMENT OF FRACTURES OF THE UPPER END OF THE HUMERUS BY A MODIFIED CRANE SPLINT

By Frank E. Peckham, Providence, R. I.

In all fracture work it is desirable not only to get union but to get it with the callus just where it is needed i. e. between the fragments and not with a large lump *surrounding* the broken ends. Another important thing from the patients point of view is to get as perfect restoration of function as possible. This is best accomplished by having the bone in perfect alignment longitudinally and also with reference to the rotation of the fragments. The short fragment in the upper end of the humerus has been somewhat of a bugbear and it has been considered necessary to abduct the arm or long fragment in order to place the broken ends in good apposition. A recent writer has arranged a splint to which extension may be applied and not only puts the arm in *external* rotation but at the same time puts the patient to bed.

In considering any fracture, the treatment should if possible tend toward simplicity and away from complexity. In studying

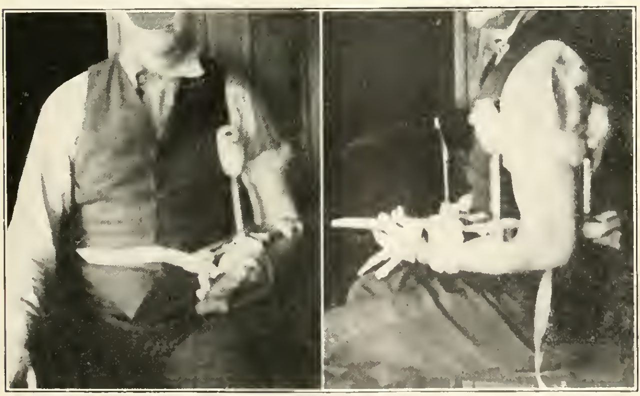


Fig. 1. Fig. 2.

Showing the splint held in place by the patient.

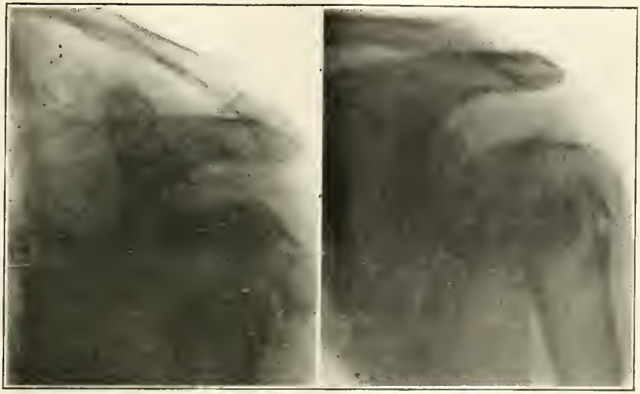
these cases the position which would naturally hold the fragments of this particular fracture in apposition, was with the arm at the side and the forearm, neither internally nor externally rotated but *straight out in front.* If possible the reducing mechanism of a fracture should be the mechanism which is going to hold it permanently in place when reduced.

In the Journal A. M. A., July 1, 1911, Dr. A. A. Crane of Waterbury, Conn., described a splint with screw attachments which created extension and counter extension by pressure against the

CASE 1.

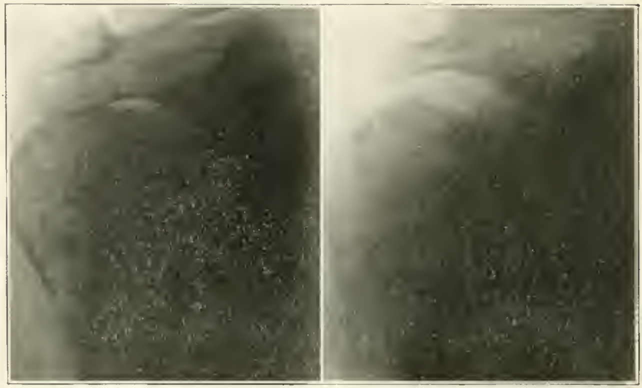
axilla, at one end of the arm and at the other end against the forearm held at a right angle. In his splint the arm was slung across the body in front, thus internally rotating the long fragment. In my own work the fragments could not be held very well because of this internal rotation. A study of cases led me to modify the splint so that it would hold the arm straight out in front. After that it was plain sailing and the treatment of any of these fractures at the upper end of the humerus was very simple. However, like all mechanisms it needs constant attention to keep it 100 per cent efficient and also to keep the patient comfortable.

The Modified Splint is rather difficult to describe but the photographs in Fig. 1, 2 and 3 give a pretty good idea of the mechanism.

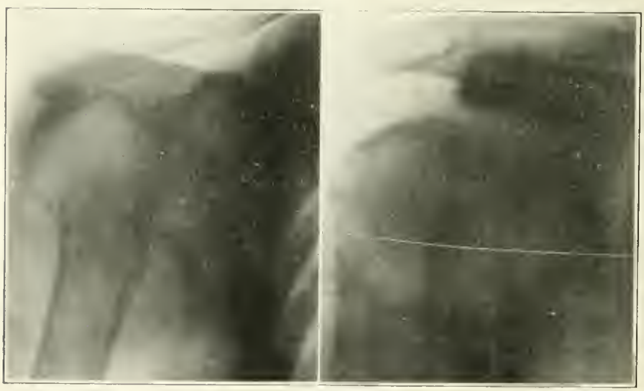


CASE 2.

CASE 2.—Comminuted Fracture.



Case 3.



Case 4.

Fig. 3 shows the splint with the curve which fits around the body at the waist line, the curved axillary crutch at the top and the long anterior arm under which the forearm and hand are strapped and bandaged.

In Fig. 1 the patient was simply holding the splint in position for illustration.

In Fig. 2 the splint is shown in actual use.

The strap of webbing extending around the waist is covered by a much wider strip of adhesive plaster to prevent slipping. This keeps the arm out straight in front, thus preventing internal rota-

Case 5.

tion. A wide strip of adhesive plaster is passed around the extreme end of the anterior arm of the splint, up over the shoulder and continued diagonally downward across the back. This holds the forearm up at a right angle and prevents anterior deformity. The splint is easily applied, ether is unnecessary and there is practically no discomfort in its application. The patient neither has to go to bed nor have the arm in the unsightly and awkward position of abduction.

Cases 1, 2, 3, 4, 5 and 6 are very well shown in the roentgenograms before and after reduction. Case 7 was a boy who not only

had a fracture of the surgical neck of the humerus but such other injuries, that bed treatment was necessary. With the arm at the side of the body, an extension was applied the whole length of the arm from the level of the fracture, the cord extending over a pulley at the foot of the bed. Counter extension was obtained by a padded band of webbing, under the axilla, the cord extending over a pulley

Case 6.

at the head of the bed. The roentgenograms show the condition of the fragments before and after its application.

These cases demonstrate that with the arm in the position described, extension and counter extension will positively reduce such fractures and the splint illustrates how they may be treated in an ambulatory manner.

SUGGESTIONS FROM THE BRACE SHOP

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From the Orthopaedic Service of the Iowa State University Medical School.

We have realized from experience gathered during the war that standardization of mechanical appliances in Orthopaedic Surgery may be accomplished to the greatest possible advantage.

We have made an effort in our work at the Children's Hospital to standardize our own braces for similar reasons. By this is not meant any standardization in size, except in cases of hand splints and the like, but rather in the working design. We believe that no brace should ever be used that is not designed to fit the exact measurements of the patient requiring it. But, by having a clear understanding of the end to be accomplished, and the means of accomplishing it, the shop is able to put out better braces and at a more rapid rate of speed than it could do otherwise.

Let us take up a few selected braces from the following standpoints: First, mechanical function; second, durability, lightness, comfort and cost to the patient; third, simplicity and standardization in construction.

(A) Body Braces

They are used in the various stages of scoliosis, fractures, Pott's disease, back strains and post-operative spine cases.

In all of these the principal mechanical function is that of support, and this support must come from the pelvis. How can this best be obtained and what is the most effective way of gripping the pelvis so as to withstand considerable pressure from above? The basis of all our standard body braces as designed by Dr. Steindler, is a firm grip above and below the entire crest of the ilium, encircling the anterior superior spines. This gives a firm, stable pelvic girdle which grips just above the trochanters on the

sides, and rises up slightly in front to allow complete flexion of the leg. The band above the crest offers a secure barrier against downward movement of the brace.

Having this basis to build upon let us look to the accomplishment of our support from above. We have only two possible means of extension, by the chin and occiput, and under the shoulders. In

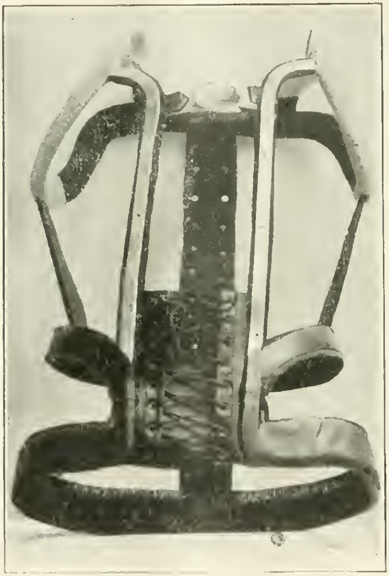


FIG. 1.—Standard body brace.

cases of scoliosis we know that it takes, in the standing position, from 50 to 100 pounds to accomplish any appreciable correction in an adult. It is, therefore, beyond belief that any patient could stand a corrective brace designed on such a working principle, and one must necessarily resign himself to the principle of immobilization. For cases requiring support from the mid-dorsal region downward, a brace with properly designed and fitting crutches and

a firm pelvic girdle, will answer the requirements of support. This is done by means of two strong steel stays up the back, a cross bar extending about the level of the spines of the scapulae, ending in firm crutches under the arms. The foremost part of the crutch is flattened out to exert some pressure backward just below the clavicle. They are well supported in front by anterior steel stays

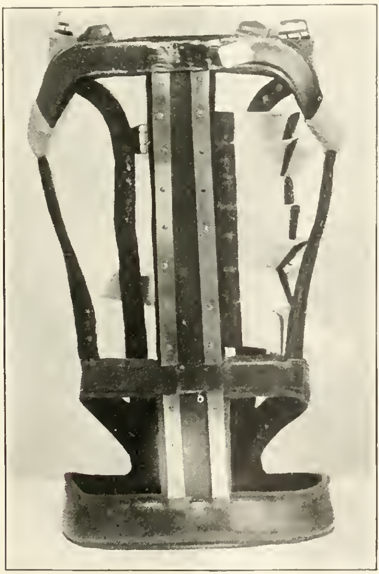


FIG. 2.—Back view, showing elastic straps over prominence of ribs.

extending down to the girdle. To give the crutches further support, a flat steel bar is run from their center down to the girdle-band just above the crest, as may be seen in Fig. 1, 2 and 3, these braces are firm but very light. The sheet-steel parts are covered on the outside with calf skin and on the inside with felt, except for the stays which are polished or plated.

Where a curvature is being dealt with, eight to twelve one-inch adjustable elastic bands are fastened in front and behind to the steel stays over the prominence of the ribs in a diagonal position exerting pressure upward and forward.

It takes approximately eight to ten hours for this brace to go through the different departments of the shop, at an actual cost of $20 to $30.

FIG. 3.—Showing firm pelvic grip and crutch support.

We have found that in getting a good fit in cases of extreme scoliosis it is very necessary to trim the models down one-half an inch to an inch from under the arm on the side of the curvature. This is not made up for under the other arm. It is also important in taking the model to give the bracemaker every possible benefit of corrected position.

This brace has proved itself entirely satisfactory from every standpoint. We feel that we can trust it to maintain any correction accomplished in scoliosis, any post-operative case, or any tuberculous case to which we wish to assure proper support. Still we do not infer that this or any other body brace that has come under our observation, is adequate, in cases of high dorsal or cervical curvatures to insure even maintenance.

No attempt is made to correct a curvature with the brace. It is used only as a support.

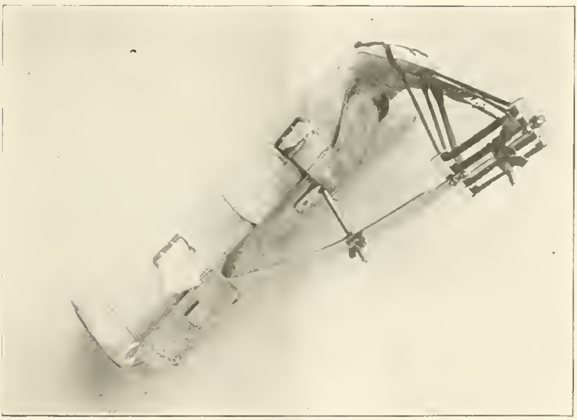


Fig. 4.—Cock-up double-traction splint, showing how traction is applied by means of a glove.

B. Glove Traction Splint

There have recently been many varieties of cock-up traction splints advocated upon various sound mechanical principles. We have been making in our shop a cock-up traction splint which has been used very effectually in cases of Volkmann's contracture, Claw Hand, and other flexion and hyperextension deformities of the metacarpo-phalangeal joints, such as are met with in trauma, nerve injuries and arthritis deformans. The principle, as has been previously described by Dr. Steindler, is a two-way traction sys-

tem. A cock-up splint covered with felt is the basis. Two adjustable T-bars are placed on a strong spring-steel shaft in such a way that direct horizontal tension is applied to the distal portion of each finger and a perpendicular tension to correct the deformity in the metacarpo-phalangeal joints. Owing to the difficulty in attaching any pulling apparatus to the skin, a good fitting glove with leather strips sewed upon it is used. The apparatus with the glove applied may be seen in Fig. 4.

The mechanical problem in the flexion contracture of the fingers is the stretching of the flexor tendons and the capsular structures of the joint. The tendons are made taut by the cock-

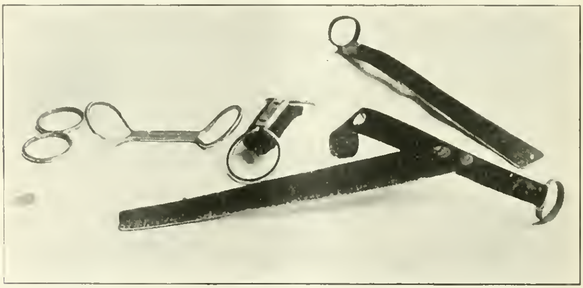


FIG. 5.—Individual finger splints. Figure-of-eight splints and two varieties of ring splints.

up, increasing the flexion in the fingers. The horizontal pull tends to overcome flexion in the phalangeal joints, the perpendicular pull hyperextension in the metacarpo-phalangeal joints.

This splint is light, durable and may be regulated in its pull to the endurance of the patient. It can be put out in one and one-half hours at a cost of $3 to $4. We have had uniformly good results in its use. This splint may be varied according to the necessities. In one case of arthritis where there was marked hyperextension of the inter phalangeal joints, heavy wire was used in form of loops, one extending around the wrist dorsally over the joints, while the other was arranged to get a horizontal and downward pull from the finger tips.

(C) Finger Splints

Where there are many cases of injury to the hand and fingers, and especially cases where skin grafts are done, the after-splinting becomes a very important factor in the end result. Palmar splinting with tongue depressors and the like may serve for a time after the operation, but when contraction of the scar tissue begins, it takes more than this, and more than 15 to 30 minutes of massage and stretching daily to obtain everything there is to be obtained. The ingenuity of the surgeon is sometimes considerably taxed when he feels that the apparatus in use is, through discomfort or difficulty to hold in place, not doing everything it should.

The most satisfactory individual finger splints with which we have come in contact, are shown in Fig. 5. They are, from left to right:

The Figure-of-eight splints, used in either flexed or hyperextended fingers. They are made of wire and may be manipulated to sustain whatever position is desired, and may be placed on the finger easily by putting them first upside down, then turning them. Small pieces of felt are used where pressure is exerted.

Above, is a ring splint, for the second, third, fourth or fifth finger, and below, for the thumb. These splints are easily applied and we have found them unusually well tolerated by the patients. They stay on well and may be bent to exert any amount of pressure. Pressure points here also are protected by small pieces of felt. They are best maintained by placing a strap or broad piece of adhesive just above the wrist. In one case of skin graft for congenital contracture where the operative outcome was uncertain, a ring splint was applied with an entirely satisfactory end result.

(D) Supination of the Arm: Fig. 6.

The mechanical problem here is to obtain the best possible grip for rotation of the forearm and wrist. This is best accomplished above by gripping the humerus while the elbow is flexed. In order that this gripping may withstand rotation two circular bands are used, one high up and the other as close to the elbow joint as possible. The palm of the hand offers the most durable

gripping point distally, and here an oval band through which the four fingers are thrust is employed. To steady the brace and prevent rubbing, another band is made just above the wrist joint.

The brace is of very simple construction, being made of 3/16 inch. Bessemer rods with the bands brazed on. It is made in less than an hour at a cost of about $1. The amount of supination may

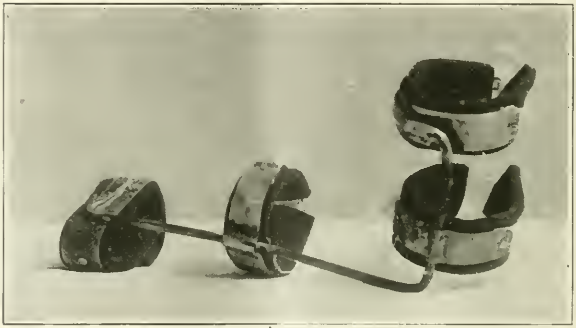


Fig. 6.—Light splint running along inner side of arm to counteract pronator contracture.

be adjusted at will. It is very useful in pronator contractures and also maintains the wrist in a hyperextended position as desired. The patient wears this brace with considerably more comfort than any other supination brace we have tried.

(E) Felt Arch Supports

When the trend of Orthopedic opinion led so completely away from solid arch supports of any kind, it became necessary to introduce some means to give temporary relief in the various foot strains. Orthopedic heels, wedges and strapping with adhesive and felt pads have done much to aid in this way. Still in the majority of these cases after the acuteness of the affair has subsided, the strapping becomes a hindrance to the institution of foot exercises, and it has been necessary to give this temporary support in some other way.

In addition to the Orthopaedic heels and wedges, we have been using in our work a temporary arch support made of common thin-leather insole, upon which is sewed two, three or four thicknesses of felt arranged in concentric lamellae. We rely entirely upon the pedographic picture, as advocated by Rich, to determine what shape

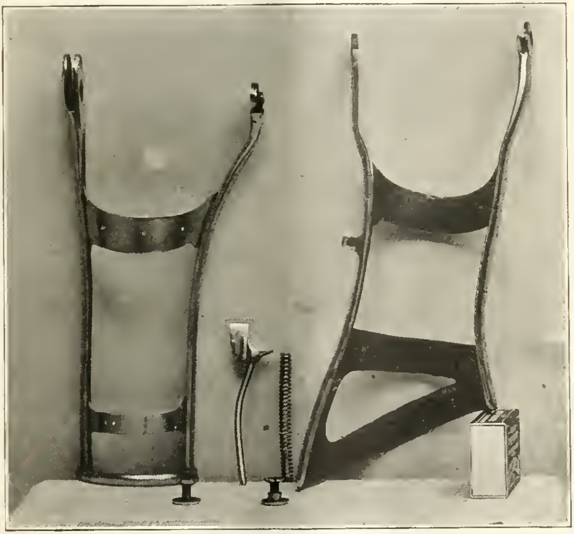


Fig. 7.—Unassembled lock-knee joint, showing two types of milled joints.

this support shall be, whether or not it shall have a tongue to support the anterior arch and whether or not it shall extend entirely across the foot. In cases of acute foot strain where there is often a cavus, much relief seems to be given by extending the felt entirely across.

(F) Leg Braces

Joints: The question as to how and where a knee joint should be placed is a matter of considerable concern. It is not practical to duplicate the exact mechanical action in the knee joint (Braasche Sector Splint). The flexibility of the soft parts upon which the

sustaining bands rest will of themselves allow considerable change of position. An important essential in a successful knee joint is to get the hinges as near as possible to the center of the tuberosities of the femoral condyles.

Fig. 8.—Lock-knee joint of the tongue-and-groove type, showing mechanism.

But the most important fact about any joint is that it is a mechanical thing and must obey the law of mechanics. It is, therefore, absolutely necessary to the proper working of any joint, whether in the knee, ankle or elbow, that the gliding surfaces of the pair be in the same horizontal and the same parallel plane one with the other. There should be no attempt, therefore, to force a joint in any way to conform to the model. It should be a mechanical thing apart.

The two types of joints that have obtained greatest favor with us are the tongue-and-groove joint (as seen to the left in Fig. 7), and the circular milled joint (to the right in Fig. 7). The former lends itself more readily to the lock-joint attachment, one type of which is shown in Fig. 8.

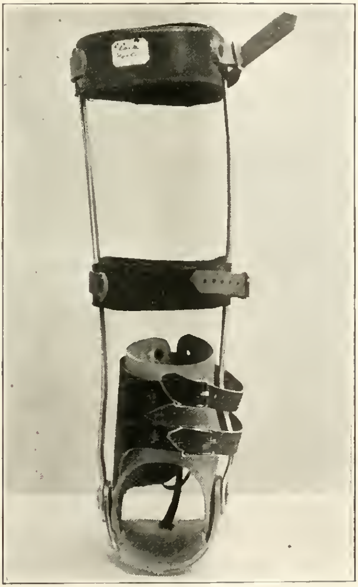


Fig. 9.—Short leg brace showing upper part of foot plate, anklet, and alignment of joints.

The circular milled joint has a bushing on the male part over which the female part glides. In this way the connecting bolt may be thoroughly tightened without interfering with the motions.

Note in Fig. 9, that there is considerable allowance for the desired varus correction. However, the joints work with each other in all planes.

(G) Foot Plates and Anklets

We have standardized our foot plate as follows: It reaches only to the ball of the foot; it rests flat in the bottom of the shoe conforming with a slight arch to the foot; it is built to fit the foot in the corrected position and no foot needing correction is fitted with a foot plate until it has been corrected.

Fig. 10.—Heavy iron bench-block with various attachments. There are several sizes of the iron foot models.

The foot is maintained in position by an anklet which extends from the ball of the foot to well above the ankle. This gives considerable support and prevents irritation that might arise from the uprights.

Fig. 10 shows a heavy iron bench block with a number of attachments which are of great value in brace work. They can easily be obtained from a foundry upon furnishing a wooden or plaster of Paris model.

I should like to say in conclusion that a thorough system of order cards and a double card-file system, used even for the most minute piece of work, is of inestimable value in the successful running of a brace shop.

Special Article

THE SURGICAL TREATMENT OF SCOLIOSIS

By A. Mackenzie Forbes, Montreal.

The thorax moves as a whole. No vertebra or no rib is moved singly. The thorax moves as a whole and each component part has its own part to play during any movement of the thorax. Physiological movements of the thorax are intricate. Physiological scoliosis is a complex condition. Pathological scoliosis is equally complex and differs only from physiological scoliosis in that in physiological scoliosis there is a return to the normal whilst in pathological scoliosis there is no return.

For these reasons the correction of a pathological scoliosis is difficult. It was suggested some years ago that the rational treatment for pathological scoliosis was to produce a physiological scoliosis of a reverse character, but it has been rightly contended by the author of that method of treatment that vertebrae which have been pathologically changed, now being wedge shaped, are carried individually and collectively into a new position by the production of this physiological scoliosis forming, indeed, an area of pathological scoliosis of a reverse character to the physiological scoliosis now produced. In other words pathological scoliosis is a more advanced condition than physiological scoliosis. We cannot cure the greater by the less.

It has been contended that in certain methods of treatment forces which are applied to produce a beneficial result in one place may produce the reverse in another.

It cannot be denied that there are patients afflicted with scoliosis of such degree that no form of treatment yet devised can be depended upon to relieve their deformities.

May we say that all schemes or methods of treatment for scoliosis have their limitations? Surely we may contend, without exaggeration, that this is true.

Assuming, then, the truth of this assertion, we will agree that we must accept as inevitable certain degrees of scoliosis. In the treatment of such degrees of deformity we have to content ourselves with two things only. First, to obtain the best correction possible. Second, to maintain this correction.

Various methods have been devised to obtain the greatest possible correction of scoliosis. Many believe that of all methods that of Abbott can best be depended upon to give correction. Calve also has made an important contribution to our knowledge of corrective methods. The Scoliosis Commission of the American Orthopedic Assn. have reported that the Lovett

method has, in practice, shown the best results. The writer still believes that the production of physiological scoliosis, of a reverse character to the existing pathological scoliosis, is the most rational method. The writer still feels that the degree of physiological scoliosis obtainable depends on previous treatment conducted on rational lines. But the writer again contends that in that class of patients suffering from scoliosis where the vertebrae, ribs and trunk are deformed, all methods can be considered, only, as a preliminary part of further treatment. Further he believes that operative procedures alone can be depended upon in certain cases of scoliosis.

As yet no operative procedures have been devised to eradicate the deformities of pathological scoliosis, but if the physiological principles first annunciated by Feiss may be considered as proved then the thorax moves, as a whole, and we may maintain any correction which may be made by such measures as fixing or welding together the vertebrae which have been placed in a position of as great correction as possible.

Doubtless there must be many ways of doing this. In 1913 the writer reported a case of operation for the relief of structural scoliosis following Poliomyelitis. Since his return to this country he has been attempting to secure fixation by freshening the surfaces of the laminae and spinous processes of adjacent vertebrae, in a very similar way to that originally used by Hibbs of New York in the treatment of Potts Disease of the spine.

The efficiency of this procedure has been demonstrated recently, when the spine of a patient who had undergone this operation over a year ago was exposed. Over the spinous processes and laminae a strong bridge of bone had formed. This held the vertebrae as though welded together.

The actual operation is usually carried out in two stages. The lumbar curve is usually operated upon before the dorsal curve. A correcting plaster is applied as early as possible, indeed not later than a week after the operation. The patient is maintained in this plaster for at least three months.

In conclusion the writer would say again that he does not believe that any method has been devised for the rapid and complete reduction of pathological scoliosis. Ofter the operator must be satisfied with a comparatively moderate correction of the existing deformity. In such cases operative procedures are recommended as precautionary measures to prevent an anticipated progressive deformity. In many patients almost any procedure would be justified to allay the progress of this condition.

Editorial

The following is taken from the editorial pages of the Medical Record of May 1. (Italics are ours.)

One of the surgical lessons of the war, learned largely through the labors and teaching of Professor Willems of Belgium and Mr. Dowden and others of England, is the *undesirability of immobilization in the treatment of broken bones, not only gunshot fractures but those occurring in civil life as well.* Mr. William Guy, writing in the Edinburgh Medical Journal, March, 1920, applies this principle of mobilization to the treatment of fractures of the mandible. He is of the opinion that there is no fracture on which there has descended with greater malignity what his friend Mr. Dowden has called "the curse of immobilization." Guy quotes from Lucas Championniere's classic "Traitement des Fractures par le Massage." In support of the view that prolonged immobilization is usually contraindicated in the treatment of fracture of the mandible. Guy describes at some length the technique of the methods for treating different kinds of fractures of the mandible. He even goes so far as to believe with his mentor, Lucas Championniere, that the dictum that movement is necessary for the successful treatment of fractures is even more applicable to compound than to simple fractures, and acting on these principles he has treated over four hundred fractures of the mandible caused by gunshot wounds of every degree of severity. In the result he is confirmed in his conviction that "le mouvement c'est la vie."

The above is a part of the reason why we have had and shall have difficulty in securing the general adoption of adequate splints for the fixation of fractures. Harm may have been done occasionally by the too prolonged immobilization of joints in the immediate vicinity of infected fractures. Much more harm has been done, however, by failure to adequately immobilize fractures—and such teaching as the above is harmful beyond computation.

Personal

At the meeting of the Central States Orthopedic Club in Memphis, April 26, Dr. F. J. Gaenslen of Milwaukee, was re-elected Secretary. Dr. H. Winnett Orr, was elected President. Dr. Willis E. Campbell showed a large number of interesting cases and entertained the visiting members most generously.

Dr. M. S. Henderson was elected chairman of the Orthopedic Section of the American Medical Association at the meeting in New Orleans. Dr. H. B. Thomas of Chicago was re-elected Secretary for three years.

The section meeting was well attended and well conducted. Dr. Roland Hammond of Providence, Rhode Island, presided in the absence of Dr. Hawley. Dr. Ridlon was re-elected to represent the Orthopedic Section in the House of Delegates.

"Sir William Osler as Host to Americans in England during the war," is the title of an article by Dr. George William Norris in the American Journal of the Medical Sciences for May. This article will be of interest to a number of Orthopedic surgeons. It contains a portrait of Sir William in uniform. The writer of this paragraph recalls a visit during this period by Sir William to one of the hospitals where Americans were on duty. Among others Dr. Mahmud Bayami of Cairo was presented to him. In just a few moments they were deep in a discussion of the writings of Rhazes and Avicenna in the original Arabic. Sir William with great enthusiasm said, "Ah, they were great days—I wish I could have lived then."

Speaking at the Cardiff Medical Students Club on April 23, Sir Robert Jones is reported by the "Western Mail" to have spoken in part as follows:

"A fundamental and essential requirement for a medical school, continued Sir Robert, was a wealth of clinical material, and unfortunately, Wales could only too easily supply that material. He believed that the demand for beds at the infirmary, (King Edward VII) was urgent and pathetic, there being constantly over

1,000 on the waiting-list. A large number of those cases was deprived of early admission, and so passed over the boundary line of hope, while at least a second thousand ran the risk of permanent neglect. No fewer than 1,500 beds were needed, not 400 as at present. Recently he had been invited by the infirmary staff to advise on the organization of orthopaedics, and he had laid it down as a fundamental principle and condition that no in-patient hospital for children should be tolerated in the centre of the city, and that the existing institution should only deal with out-patient clinics with the exception of a few beds for urgent cases. Long experience had taught him beyond question the injustice of segregating sick and deformed children in the vitiated air of a city hospital ward.

"The speaker referred to the great monument for all time in the Prince of Wales Hospital erected by Sir John Lynn-Thomas, and the possibilities of the expansion of the Glan-Ely Hospital for surgical tuberculosis."

Announcement

PRELIMINARY PROGRAMME OF THE ANNUAL MEETING OF THE AMERICAN ORTHOPAEDIC ASSOCIATION, TO BE HELD IN TORONTO, JUNE 7TH, 8TH, 9TH AND 10TH, 1920.

Monday, June 7th, Clinical Day.—This day will be spent at the Hospital for Sick Children and the Military Orthopaedic Hospital.

At the Hospital for Sick Children the programme will commence at 9 a. m. and will be arranged as follows:

1. Operations by the Staff illustrating the operative treatment of fractures and the fixation of tendons in infantile paralysis.
2. Presentation of Cases illustrating the late results of tendon fixation.
3. Presentation of Cases illustrating the results of the free transplantation of tendon and fascia.
4. Demonstration of the experimental method of studying the free transplantation of tendon and fascia.
5. Presentation of Cases illustrating the treatment of acute osteomyelitis.
6. Presentation of Cases illustrating the treatment of Pott's disease with heterogenous bone-grafts.
7. Presentation of unusual cases.

At the Military Orthopaedic Hospital the programme will commence at 2:30 p. m. and will be arranged as follows:

1. Operations by Professor Putti of Bologna, Italy; Lt. Colonel C. L. Starr, and Major D. E. Robertson. These operations will illustrate the method of cinematic amputation, the transplantation of tendons for irreparable nerve injuries, and the treatment of non-union of fractures.
2. Presentation of cases illustrating the results obtained from the suture of nerves.
3. Presentation of cases illustrating the results obtained from the transplantation of tendons for irreparable injuries to nerves.
4. Presentation of cases illustrating the results of the operative treatment of non-union in fractures.
5. Demonstration of the methods used by the Canadian Army in the treatment of amputation cases.
6. Presentation of interesting surgical cases which have resulted from war wounds.
7. Visit to the wards, gymnasium, curative workshop, artificial limb plant, etc.

Tuesday, Wednesday and Thursday, June 8th, 9th and 10th, in the Medical Building, University of Toronto, the following papers to be presented, the time to be stated later:

Professor Jacques Calve, France—Pott's Disease.
Professor Putti, Italy—Cinematic Amputation.
Mr. Naughton Dunn, Birmingham, England—Subject to be announced.
Mr. Robert Olleronshaw, F. R. C. S., Manchester, England—Cysts of the external semilunar cartilage of the knee-joint, etc.
Dr. Z. Adams—Codivilla's Operation for the Correction of Genu Valgum.
Dr. F. Albee—Certain Mechanical Features in the Treatment of Fractures in and about the Hip.
Dr. Nathaniel Allison—Bone Tuberculosis.
Dr, W. S. Baer—The Treatment of Osteoarthritis of the Hip-joint.
Dr. Wallace Blanchard—The Jones Operation for the Ankylosis of Subdeltoid Bursitis.
Dr. A. Mackenzie Forbes—The Operative Treatment of Scoliosis.
Dr. Albert H. Freiburg—Injuries in the Sesamoid Bones of the Great Toe.
Dr. Frederick J. Gaenslen and Dr. Wm. Thalhimer—A Lesion of the Trochanter and its Epiphysis, non-tuberculous.
Dr. Herbert Galloway—Open Operation for Congenital Dislocation of the Hip.
Dr. Roland Hammond—Pain in the Great Toe from Adhesions of the Sesamoid Bone.
Dr. R. I. Harris (by invitation)—An Operation for the Relief of Median Anesthesia.
Dr. F. C. Kidner—The Treatment of Osteomyelitis Resulting from Gunshot Wound.
Dr. Robert W. Lovett—The Operative Treatment of Infantile Paralysis.
Dr. H. Winnett Orr—Review of some of the Recent Text-book Teachings on the Treatment of Fractures of the Thigh and Leg.
Dr. Archer O'Reilly—Back-ache and Anatomical Variations of the Lumbo-Sacral Region.
Dr. F. E. Peckham—The Treatment of Certain Fractures.
Dr. Chas. J. Painter—Subject to be announced later.
Dr. Howard Prince—The Treatment of Old Fractures of the Os Calcis.
Dr. Edwin Ryerson—The Treatment of Osteomyelitis Resulting from Gunshot Wound.
Dr. Robert Soutter—Osteomyelitis of the Patella.
Dr. Jas. Warren Sever—Indications for and the Results of Astragalectomy in Infantile Paralysis.
Dr. Arthur Steindler—Congenital Malformation of the Hand.
Dr. Walter Stern—Chronic Circumscribed Osteomyelitis.
Dr. Walter Truslow—The Non-operative Treatment of Scoliosis.
Dr. Sidney A. Twinch—Preventive Orthopaedics.
Dr. Royal Whitman—Demonstration of the Results of Treatment of Fracture of the Neck of the Femur by the Abduction Method.
Candidates Theses.

On Tuesday evening the Association will be the guests of the Officer Commanding and the Officers of the Dominion Orthopaedic Hospital at a smoker to be given in the hospital.

On Wednesday evening the annual dinner will take place at Hart House. The regular meetings will be held in the Medical Building and luncheon will be served daily at Hart House.

The corrected programme will be in the hands of the members of the Association in the last week of May.

BRITISH ORTHOPAEDIC ASSOCIATION

SPECIAL MEETING JUNE 4TH & 5TH, 1920,
EDINBURGH

President: Sir Robert Jones, K. B. E., C. B.

PROGRAM

Friday, June 4th. In the Systematic Surgery Classroom,
Edinburgh University

Morning Session

9:30 a. m. Executive proceedings.

10:00 a. m. Discussion on "The Principles of the correction of congenital talipes equino-varus and particularly of inveterate and relapsed cases." Opened by Mr. R. C. Elmslie.
"The results of tendon transplantation for paralysis of the muscles below the knee." Mr. John Fraser. (by invitation)
"Acute arthritis of the hips in infants." Mr. S. Irwin.
"Traumatic dislocation of the knee joint." Mr. Harry Platt.

1:00 p. m. Luncheon.

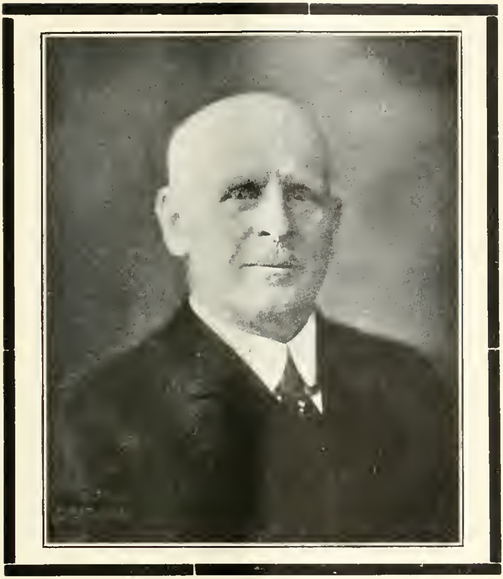
Afternoon Session

2:00 p. m. "The end results of arthroplasty of the knee joint." Professor V. Putti. (Bologna)
"Hallux Valgus, rigidus and malleus." Dr. Murk Jansen, of Leyden.
"The vital and mechanical factors in bone grafting." Mr. E. W. Hey Groves.
"Some notes on bone, fascia and tendon grafting." Mr. A. P. Mitchell. (by invitation)
"The possibilities of end to end suture after extensive nerve injuries." Miss Forrester-Brown. (by invitation)
Demonstration of cinematographic records illustrating the various types of gaits in children. Mr. John Fraser.

7:30 p. m. Association Dinner.

Saturday, June 5th. At the Edinburgh Royal Infirmary.

9:30 a. m. Operations and demonstrations of cases. Sir Harold Stiles.



DR. BERNARD BARTOW

Bernard Bartow was the fourth son of John and Katharine B. Bartow. He was born in Flint, Michigan, December 1, 1849. At the age of two years he came with his parents to Buffalo, where he spent the remainder of his life. He was the great-grandson of Mrs. Gamaliel St. John, noted in the history of Buffalo, as being the only person who saved her home in the burning of Buffalo during the war of 1812. Dr. Bartow was educated in the public schools of the city, and at the age of fifteen years, was made assistant to Mr. William Ives, librarian of the Young Men's Library, afterwards merged into the Buffalo Public Library. He graduated from the University of Buffalo in 1874, and was made an interne at the General Hospital immediately after graduation. Dr. Bartow was married by the Rev. Phillips Brooks June 26th, 1879 to Fanny F. Howes, daughter of Osborne Howes, Esq., a retired ship merchant of Boston.

Dr. Bartow started work as a surgeon, but possessing marked mechanical ability, his attention was directed to orthopedics, from the character of the cases referred to him. For a number of years he was the only man doing that special line of work in his part of the state.

Dr. Bartow was elected to the American Orthopedic Association in 1889.

At the time of his death he was: Orthopedic Surgeon in Chief, Children's Hospital. Consulting Orthopedic Surgeon, Buffalo General Hospital. Emeritus Professor of Orthopedic Surgery, Medical Dept., Univ. of Buffalo. Was a fellow of the American College of Surgeons, and local medical societies.

W. W. PLUMMER.

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Current Orthopaedic Literature

Treatment of Denervated Muscle. By Frank A. Hartman, Ph. D., Professor of Physiology, University of Buffalo, Department of Medicine, Buffalo, N. Y., and W. E. Blatz, M. A., Toronto, Canada. *The Journal A. M. A.*, Vol. 74, No. 13, 3-27-20.

The generally accepted methods of treatment for denervated muscles are either massage or electrical stimulation. Until the investigations of Langley and his collaborators, no experimental work seriously questioned the value of massage or electrical treatment in a muscle whose nerves had been destroyed. Although Schiff, from observations that he had made on the tongue and the limb, concluded that fibrillation is a general phenomenon in muscle and nerve section, Langley was the first to suggest that the atrophy is due to continuous fibrillation. Fibrillation begins 4 or 5 days after nerve section, and persists until some of the regenerating fibers make connection with the muscle. Such incessant activity might well cause wasting of the muscle. Langley and Kato were able to check fibrillation by the intravenous injection of considerable amounts of calcium chloride. They demonstrated no change from the feeding of calcium lactate.

The authors have investigated the effects of massage on denervated muscles. Instead of depending entirely on the weight for comparison of the treated and untreated muscles, the work capacities were also determined. With the functional test as the method for comparison, the massaged muscles were found to be stronger in 62 per cent of the animals treated.

Massage—The right limb of each animal was massaged for a certain period each day, varying from 2 to 20 minutes. Both right and left limbs were given passive movements three times at each treatment to aid in preventing stiffening of the joints. The feet were always encased in aluminum boots.

Galvanism—A series of 24 animals were treated with the galvanic current. This treatment consisted of shocks produced by a metronome connected in the circuit, the aim being to secure a certain magnitude of contraction. This magnitude and duration of treatment varied in different rabbits. The contractions were roughly classified into minimal, moderate and vigorous. The duration varied from 5 to 15 minutes, but in many cases each alternate minute was allowed for rest. A greater voltage was required to produce the same magnitude of contraction as degeneration progressed.

Both the electrical and the massage series may be discussed together, for neither treatment appeared to produce any greater effect than the other. The treated limb on the whole did not appear to be any better off than the control limb.

Within the first month after denervation, there was a very marked drop in the power to respond to galvanic stimulation. This occurred alike in the two limbs.

In addition to the series in which the nerves were crushed or cut and immediately sutured, we have studied a series of 41 rabbits in which the proximal end of the nerve has not been permitted to unite with the distal end for periods varying from 30 to 100 days. These animals were treated either by massage or electricity. The treated muscles lost their galvanic response just as quickly as the controls. Moreover, neither message or electricity caused the denervated muscle to recover from the diminished response. Fourteen per cent of the rabbits did show a slight advantage on the treated side, but it was no more than would be expected from accidental variation.

Denervated muscle is not a muscle at rest. It is undergoing abnormal changes of which fibrillation is perhaps only one. Such changes are probably the cause of muscle atrophy, for Langley and Itagaki have shown that there is an increase in the rate of breakdown of the muscle substance.

The authors conclude from their present researches that massage in denervated muscle is futile. Galvanic treatment likewise appears to produce no beneficial effect.

The sciatic or tibial nerve was cut or crushed on both sides of 123 rabbits. The denervated muscles on the right side were either massaged, or else stimulated by galvanic shocks daily.

Union of the cut nerve was prevented in 41 animals, and in the others it was favored by suture or by crushing instead of cutting. The right and left muscle groups were compared every 10 to 14 days by a determination of their power to do work when stimulated by supermaximal galvanic shocks while the animals were under the influence of ether.

Neither massage or galvanic stimulation prevented the loss in galvanic response which normally develops a few days after denervation. Treatment likewise did not appear to cause a more rapid recovery of the muscle when the nerves were permitted to grow down to the muscle fibers. Galvanic response and voluntary function in the denervated muscle returned much earlier in crushed nerve cases than in cut and sutured cases.

In all their work the authors have been unable to demonstrate benefit from massage or galvanic stimulation.—*Leo C. Donnelly, Detroit.*

A SUBSTITUTE FOR OPEN OPERATION IN SOME IRREDUCIBLE FRACTURES. By J. Stanley Welch, M. D., Lincoln, Nebraska. *The Journal A. M. A.*, Vol. 74, No. 12, March 20. 1920.

Pursuant to the surgical principle of accomplishing most in the least radical manner, we have resorted to a simple method of reduction in several cases of fracture in which open operation seemed obligatory.

The mechanism of the reduction is a lever in the form of a small, strong steel probe acting between the displaced fragment ends and retained in situ by the plaster cast. It is resorted to under aseptic conditions with anaesthesia, while being observed under the fluoroscopic screen. The instrument is intro-

duced through the iodized skin on the side of the extremity most remote from large vessels. Its end is guided by watching in both axes under the fluoroscopic screen. It is carefully placed between the fragments in such a manner as best to pry them back into apposition. When they are reduced, the instrument may be withdrawn; or, in the event of a recurrence of displacement, it is surrounded with a small sterile dressing and the plaster splint is immediately applied. When this is firmly set, the protruding part of the instrument is cut off with a hack saw. No infection should occur, and in from seven to ten days the probe is removed with a pair of pliers without a change of the cast unless otherwise desired. No death of bone should occur in this time with the degree of pressure here necessary.

Occasionally one finds in a fracture of both bones of the forearm or leg an irreducible condition of one or both bones. It is a frequent experience to find that, once reduced, they do not so remain. This simple method will satisfactorily retain many such fractures and prevent a much more radical operation or a more cumbersome dressing in extension.—*Leo C. Donnelly, Detroit, Mich.*

Operative Treatment of Spinal Tuberculosis. By John Fraser, F. R. C. S. *Edinburg Medical Journal*, January 20, 1920. New Series, XXIV, No. 1.

While the tendency has been to minimize the operative treatment of bone and joint tuberculosis in children, the operative treatment of spinal tuberculosis has increased in popularity. The two classes of operation have very different objects in view, for in the latter no attempt is made to eradicate the disease but to secure what may be called an internal splint of bone, and so to induce by fixation of the part a more efficient natural cure. The types of operation generally performed are those associated with the names of Albee and Hibbs.

Henderson, in the most recent paper on the subject reports 81 cases of Pott's disease. He claims a proportion of cures amounting to 43 per cent and in his series, there were no operation deaths.

The success of bone grafting for spinal tuberculosis has now become definitely established but there are certain details of the method which must be adhered to if ultimate success is to be gained. Alkalies and carbohydrates should be administered for some days previous to operation and chloroform should not be employed as the anaesthetic of choice. The precautions are necessary owing to the frequency of an acidosis in prolonged bone operations in case of children. With Albee's saw the time of operation can be greatly shortened and the shock reduced. Instead of the graft being placed between the split vertebal spines, it may advantageously be laid laterally along the sides of the spines. As the whole idea is to induce the formation of new periosteal bone and so secure efficient internal splintage, it is most important to separate the periosteum widely from the spines, laminae, articular and transverse processes. Only by so doing can a sufficiency of new periosteal bone be formed. A spine which has been efficiently treated should at the end of six months show an appearance as though a quantity of liquid wax had been formed over the posterior surface of the spine—so profuse should be the new bone formation.

Attention must be drawn to the danger of rough handling under the anaesthesia during the operation. The support of the erector-spinal muscles is gone and the spine may buckle or dislocate backwards if any unguarded movement is made.—*James R. Elliott, Kansas City, Missouri.*

REPORT OF PATIENT 6 YEARS AFTER THE TRANSPLANTATION OF A HOMOPLASTIC BONE GRAFT. By Henry Wade. *Edinburg Medical Journal*, January, 1920, New Series XXIV, No. 1.

CASE—August 12, 1913, W. W., age 27, admitted to Royal Infirmary, Edinburg, seven days before had fallen on right shoulder followed by numbness and inability to move shoulder. X-ray showed fracture of shaft of humerus running into the joint, thinning of the bone substance suggested pathologic fracture. Patient had had injury to the same shoulder two years previously, a fracture of the shaft through the level of insertion of the deltoid which healed promptly with some limitation of motion.

In August, 1913, patient was operated, the operative work that morning being so arranged that the case immediately preceeding was an amputation, middle of the thigh for senile gangrene, a portion of this femur was rapidly dissected out with all aseptic precautions leaving the internal condyle with its articular cartilage intact. Then the head of the humerus with six inches of the shaft was resected, leaving a cuff of one and one-half inches of the periostum projecting above the remaining portion of the humerus. The graft having been prepared in proper length was placed in situ and the muscles sutured over the graft with no further attempt to fix in position.

He remained in the hospital only four weeks and returned after another month. A short time later he resumed his work as a mill worker.

When examined in November, 1919, a firm mass of bone was felt occupying the position of the implanted graft. This new bone was firmly united to the shaft of the humerus. The patient could move the shoulder joint freely in all directions with some limitations, and free from pain except in extreme abduction. The deltoid was partially atrophied. X-ray showed the upper end of the humerus surrounded by a cuff of bone. The contour of the implanted graft was lost except for the upper end which had remained very much of the same appearance, the articular surface of the femoral condyle lying in contact with the glenoid cavity.

COMMENT—The result in this case was most satisfactory and had enabled the patient to continue his occupation for the last six years. The fate of the implanted graft evidently was not complete absorption in view of the appear ance of the upper portion. The lost abduction probably could have been prevented by putting the arm up in extreme abduction instead of having it fixed at the patient's side.—*James R. Elliott, Kansas City, Missouri.*

To the Question of Spontaneous Fractures in the Hungerosteopathies of Adults. W. V. Simon. *Archiv f. Orthpaed. u. Unfalls-Chirurgie.* XVII. Bn. 3. Heft. Seite 364-378.

The author presents two cases of so-called spontaneous fractures in adults who have suffered from the peculiar disease of starvation which has in late years developed in central Europe as a result of undernourishment. Simon and other authors have named this bone condition: "starvation-osteopathy." From the cases quoted before in literature, these two vary in the localisation of the pathologic lesions. Instead of the common site, the upper end of the tibia and lower end of the femur, these cases have their lesions in the middle of the diaphysis of the tibia and the horizontal ramus of the pubis respectively. In neither case has trauma been the etiologic factor; it can however be assumed that weight bearing or static disturbance is the contributing cause of the fracture, which, if it found at all, is only the final result on the bone which has slowly and gradually undergone degeneration and destruction. The manner of production of this circumscribed bone lesion and the pathalogic anatomic substratum has so far remained undetermined. No autopsy has yet been available.

One of the cases may here be cited as an example:

Girl of 21, telephone operator, took sick one year ago with pain in the left ankle at first. Gradually the patient noticed a swelling of the left ankle which extended up to the middle of the tibia. The pain has extended to the middle of the tibia and is very severe when walking, while it disappears when resting.

Trauma, even of the mildest form, is entirely denied.

Findings: The patient is anaemic and undernourished. Oedema is present in both ankles, more on the left than the right side. At about the middle of the tibia one feels a circumscribed swelling which is painful and tender on pressure.

The spine shows a slight right dorsal-left lumbar scoliosis. Pressure on the sternum and the ilia is painful. Atrophy of the muscles is absent everywhere; motion in the joints is free, and the motor power nowhere reduced.

While standing the feet and hands are slightly cyanosed. Knee jerk increased, more on the left than the right side; achilles reflex present and exaggerated; otherwise nothing abnormal neurologically. Blood picture: Haemoglobin 75% R. c. 4,510,000. Leukoc: 8700 Eosinoph. Leukoc 3%, Neutroph. Leukoc 54%.

The urine negative to albumin and the Wasserman and v. Priquet are negative. The Xray, reproduced in the article, reminds one of the picture found in some persistent case of pseudoarthrosis which yield to neither conservative nor operative treatment.—*A. Gottlieb, San Francisco, Calif.*

INTERNAL DERANGEMENT OF THE KNEE. Gordon Watson. *Clinical Journal* October 1919.

The author points out that tears of a semilunar cartilage, according to experimental evidence, occur most easily during the final stage of extension, whereas clinical evidence shows it most likely to happen when the leg is partially flexed, abducted and rotated outwards. In about half the cases the tear is longitudinal and the longitudinal tear may involve the anterior part only, the whole cartilage, or the posterior portion. The external cartilage is affected in only 10 per cent of the cases.

The usual clinical history is of severe pain with locking followed by swelling. Sometimes a crack is heard at the time. Recurrence from trivial causes is common, and in the interval there is freedom from symptoms. The more chronic the condition, the less severe is the pain. The diagnosis depends largely on the history. In long-standing cases, relaxation of the internal lateral ligament and thickening of the synovial membrane may be detected. Nipping of the synovial fringes is distinguished by the symptoms being less marked and by a history of chronic disease. Locking from loose bodies may stimulate injury to a cartilage, but at some time or other these may be located in a superficial position; the diagnosis can be confirmed by roentgenogram.

Injury to the crucial ligaments and fracture of the tibial spine are always the result of severe violence. If the anterior crucial ligament is torn, while the posterior remains intact, the tibia in the extended position can be made to slide forward on the femur, while if the posterior is torn and the anterior intact, the tibia can be pushed backward on the femur without flexion.—*Thomson.*

THE THEZAC-PORSMEUR METHOD OF SUN TREATMENT. Robt. W. Lovett, M. D., Boston. *Jour. A. M. A.*, 1920. Vol. 74, No. 14.

The essential of the treatment is the concentration of the sun's rays by means of a double convex lens with a diameter of 12 inches and a focal length of 72 inches. At the focal point the heat is very great, as it would be in any lens used as a burning glass, and in general the patient should be placed at a point where the sun's rays form a circle of from 3 to 5 inches in diameter.

As the patient is moved farther away from the lens, the heat increases, and as the patient is moved nearer the lens, the heat diminishes. The degree of activity to which it is desirable to submit the wound can be regulated by carrying the lens nearer the patient or farther away.

The lens is mounted in a canvas cylinder, 1 foot in diameter and 3 feet in length, which is kept rigid by two circular wires with thin strips of wood running from one hoop to the other, over which the canvas is stretched. The lens is placed a few inches from one end of the cylinder. The advantage of this cylinder is that it enables the lens to be pointed directly at the patient and makes the application of the treatment more definite. The cylinder carrying

the lens is mounted on a tripod and can be swung in any direction by means of a handle.

The duration of the sun treatment should lengthen progressively. The first treatment should last for five minutes, and increase at the rate of about five minutes each day up to thirty minutes. In a certain case a longer period up to an hour and a half was used without apparent ill results. The skin around the wound was as a rule protected by towels, and the person giving the treatment wore colored glasses, as the light is extremely bright, and the eyes of the patient were protected if exposed to the glare of the circle of light. The patients were given one treatment a day.

The effect of the treatment on suppurating wounds were perfectly definite (1) The discharge immediately increased and then diminished; (2) pale granulations took on a healthier color, and (3) sensitiveness diminished. In order to test the efficacy of this treatment, a series of suppurating wounds of the severest type was selected, and cases that were obviously difficult. In the wards in a hospital for acute cases it was necessary to select a more acute type than would have been the case than in an institution for chronic diseases, as patients that were doing well were discharged to the convalescent home on account of the need of beds, and chiefly the chronic suppurations that were resistant remained long enough to be observed under this treatment.

There was greater progress in the cases treated by the lens than there had been before, or than there had been in similar cases. Improvement in Case L was striking. The boy had been a long time under observation, he had made no headway whatever, and from the time the lens treatment was begun his improvement was rapid and steady. In two acute osteomyelitis cases in which the treatment was used within a week after operation, it seemed to be too stimulating, the temperature rose, and the sun treatment had to be deferred.

For six years the author has had experience in sun treatment in which the whole body has been exposed, and he is a strong advocate of its value. The author is convinced that the treatment with the lens is a distinct addition to therapeutic measures. It can be delicately regulated and controlled; it is applicable when the sun is sufficiently clouded to be useless for general exposure; and it can be used in a sunny room by opening the window and pointing the cylinder at the sun. It seems free from risks when used according to directions, and it seems to embody real possibilities.

A bacterial count was made in all cases at short intervals, and a study of the cases shows that the effect of the sun treatment was to lower immediately the bacterial count in the discharge of the wound; but in several of these cases there was underlying suppuration, and the bacterial count was not affected.

The value of the treatment would seem to have been demonstrated in cases of chronic suppuration from tuberculosis, syphilis and chronic osteomyelitis.—*Leo C. Donnelly, Detroit.*

NEURO-MUSCULAR ATROPHY. Arthur Watkins, M. B., B. S. Griffith, Melbourne, South Wales. *Medical Journal of Australia*, 1920, 1:9, p. 189.

The case is that of a female twenty-one years of age, milliner by trade; had rheumatic fever three years ago, influenza in June, 1919. About four years ago her neck became very fat. In December, 1919, she noticed tingling and numbness in the toes, feet, and the legs from the knee down rapidly wasted. Within seven days from the onset a similar condition of the hands and fore arms was observed, wasting limited to the forearms downward. The hands resembled the griffon's claw. Fibrillary contractions were present in the atrophied muscles, and vaso-motor changes were apparent. A marked deposit of sub-cutaneous fat existed from the nape of the neck to the first dorsal vertebra.

The fat disappeared after one week of thyroid gland therapy, consisting of 0.3 grammes daily.—*Thomson.*

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PRESIDENT'S ADDRESS AT THE ANNUAL MEETING OF THE AMERICAN ORTHOPEDIC ASSOCIATION AT TORONTO, JUNE 7-10, 1920

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The war is yet too short a distance from us to view in proper perspective the effects it may have on the civilian surgery of the future, but still there are some lessons which we should learn, so that the knowledge attained in the struggle may be made permanent and civilian surgery be to that extent advanced and the public to the same extent be better served.

It is to some of these points that I wish to direct your attention for a brief period this morning. For some time before the war certain features of its work were being forced upon the attention of some of the members of this Association, who were thinking of its future. From a survey of the early history of the Association one is impressed with the energy and skill with which the pioneer members approached their problems and struggled for their solution. The greatest credit is due to these men for the foundations laid for the future of this branch of surgery.

The necessarily chronic nature of the types of cases coming under their purview required a degree of patience and tact which it is difficult for the younger generation in these rapidly moving times to emulate or be willing to follow.

The unwillingness of the modern patient also to consent to be harnessed up for life to a cumbersome apparatus, if by surgical means he could be relieved of this necessity, was a stimulating factor in the search for such surgical relief.

The war, with all its opportunities for study, from a mass of material hitherto unknown, was possibly the last factor in a series

of events which seemed to open up a vision of a field of work previously untouched by our Association, and yet one which our members, properly trained, were pre-eminently fitted to occupy.

In the earlier days of orthopædic surgery, the credit for its greatest strides is largely due to the men of this continent; but for the new vision of the possibilities of our special surgical branch we are indebted to the foresight, and widened horizon of one who is a great friend of this Association, and I am sure we are all united in doing him homage,—I refer to Sir Robert Jones.

The scope of the orthopædic surgeon, must, by general consent, be widened to include all of the surgery of the extremities and spinal column. The first problem which confronts us, if we accept this field of opportunity, is whether we, as individual members of this Association, are prepared to assume the responsibilities of this widened field.

The war work showed unquestionably that in some respects we were falling short of being properly qualified.

If I were asked to state the chief defects we exhibited in thus failing to measure up to the full measure of the opportunities presented, I should say they were, first: an inadequate knowledge of practical anatomy, and second, an insufficient training in the fundamentals of general surgery.

To our credit be it said, we learned rapidly, and to some extent those defects have been remedied. To the general surgeon in the war we are indebted for much that was helpful and stimulating, and in some instances where orthopædic surgeons were not available, the rapid assimilation of our special knowledge by outstanding general surgeons put them in a position to render some of the most valuable service of the war.

If these are real problems, what is the solution? It is unfortunately a fact that the average student comes to graduation in the bulk of our colleges with a very poor working knowledge of anatomy. Is this the fault of the student or the fault of our methods? It may be that both are at fault. The student is not sufficiently impressed in the early years with the value of anatomy in his surgical future and he is apt to look on this subject as a grind, so much work to be plugged for examination purposes.

There is not, possibly, sufficient correlation between his primary and his final work.

The student learns the origin and insertion of a muscle or series of muscles without relating these facts to the leverage involved or the function performed, and consequently he does not get the point of view of the surgeon who has to consider the breaking of the lever in fractures, or the loss of power of the muscle in paralytic conditions.

If the facts of muscle origin and insertion could be visualized in their action pathologically, as well as anatomically, it would add materially to the interest of the primary student in the subject. In the same way if, instead of simply learning that certain nerves supply certain muscles, a necessary but wholly uninteresting fact, a picture of the effect of interrupting the nerve, on the musculature of the limb could be presented, it would at once impress itself on the mind. In this way anatomy could be made to live and take on a wholly new aspect.

The ending of the primary years should not be the end of the anatomical teaching. It is essential that surgical anatomy and surgical pathology should be a part of every surgical clinic. In fact, a proper conception of diagnosis and treatment is almost impossible without it.

To carry this out means, of course, a working knowledge on the part of our clinicians of these subjects. Can we all qualify? It should be the aim of every Medical College to have such a properly trained teaching staff. In such cases as the orthopædic surgeon is called upon to treat, a thorough knowledge of living anatomy is essential. Many a student may know the extremity surgery in the dissecting room where all structures are exposed, but to know what structures are to be met after a certain incision through skin and fascia is made requires a knowledge of anatomy best gained by surgical experience as assistant to a competent surgeon.

The teaching of surgery in the average school of medicine may be equally open to a certain degree of criticism.

To be successful as a teacher of surgery one must have a love of the work sufficient to sacrifice one's own personal interests and monetary gain, as the bulk of schools are at present organized.

The necessity of most of us to earn a living, makes it impossible to devote the time essential to reach the highest point of ef-

ficiency possible. As a rule, with few exceptions, there is not the central control of the head of a department who can devote sufficient time for the proper correlation of all departments.

Whether orthopædic surgery is taught as a sub department of surgery, or as a separate department, is not of much moment, so long as the students get a good foundation. For those who aim at orthopædic surgery a training in general surgery is absolutely necessary. One thus develops the surgical sense or surgical judgment, and he, after such training can more adequately size up his surgical problem, and in terms of function estimate whether his patient is going to be functionally improved, or, if it is an operation for improvement of appearance, whether this will be attained.

At least one year should be spent after graduation, as assistant to a competent general surgeon in a hospital with fairly large clinical facilities. After this a further year or more is essential under the guidance of an orthopædic surgeon; and if a post can be secured as assistant attending, where the counsel and support of a chief may be possible, both in staff conferences and daily personal contact, the training would be complete.

The surgical lessons learned during the war and the subsequent reconstruction period should be made permanent, especially in so far as they affect our special department.

In the treatment of compound fractures invaluable information has been afforded. That we did not adequately handle these cases in the early stages of the war was evidenced by the large mortality from such compound infected fractures as those of the femur. The lessened suffering and decreased mortality in the later stages spoke in thunder tones to those of us who saw both stages. The comfort with which such cases may be transported should result in all civilian ambulances being equipped with Thomas Splints, and similar appliances for the upper extremity. The prevention of infection by debridement should be remembered in treatment of railroad and industrial accidents.

The information obtained during the reconstruction period in the treatment of nerve injuries by suture and nerve transfer, and the reproduction of function by tendon transference in irreparable nerve injuries, with resultant paralyses, should be made available in all suitable civilian injuries.

Our responsibilities as surgeons of the extremities will also be great in other respects. The treatment of simple fractures of bones was not greatly advanced by war experiences and the various controversies and discussions as to a standard or best method of treatment show that the desired end is not yet attained. It is for us to determine and ultimately decide, if we are to take the leading position in the treatment of these conditions, what is the best method of handling these. The fact that we are continually confronted with very serious loss of function, with malunion and non-union in so many of these cases, is evidence of the fact that as a whole the profession does not handle these cases well.

The complaints of these sufferers remind us of the lamentation of King Richard when he claims that he was "deformed—unfinished, sent into this breathing world scarce half made up and that so lamely and unfashionable that dogs bark at me as I halt by them."

To prevent such complaints and to render impossible the numerous litigations arising from such results is one of our problems. The advantages and disadvantages of steel plates and bone plates, of operative and non-operative treatment, of massage and mobilization, are all points to be discussed and order brought out of the chaotic thinking of some of our surgeons.

It should probably only be necessary to teach the principles upon which sound treatment rests to secure good results, and then the judgment of the individual should be left to decide which method will best adapt itself to fulfil these requirements. Proper length, good alignment, with restoration of function in as brief a period as possible should be the general foundation upon which all teaching should be based.

The infections of bone also form one of the problems confronting us. The early diagnosis of acute infections and the proper method of treatment is far from being as satisfactorily handled as one could desire, as evidenced by the great number of cases of extreme destruction of bone seen in any children's clinic.

The method of treatment in these cases in nearly all text-books is surely faulty and may lead to much more serious results than if nature were left unaided. The instruction to chisel into the medullary canal, is found in a great many text-books and is

surely based on a wrong conception of the pathology of these infections.

These and many other problems of extremity surgery might properly form the basis for research work on the part of some of our younger members, which would bring great credit to the individual and help to establish our Association on a more scientific foundation. It is not possible in the short space allotted to such an address as the present, even to designate the many other problems confronting us; but in view of the great prominence given to it in our reconstruction work, one other subject deserves our honest consideration, viz., the place which physio-therapy should occupy in our treatment.

The medical profession is probably responsible for the fact that so many and varied healers have arisen and command a fairly large following even among a class of people who are otherwise intelligent.

The bone setter unquestionably held his position from the fact that the medical profession failed to recognize and bring into use in a legitimate way, that modicum of truth which undoubtedly existed in his practice.

There apparently is not even so large a germ of truth in the various other "pathies" with which we are surrounded and which flourish as in a natural habitat in the Republic to our south. The electro-therapeutist and hydro-therapeutist in our midst, although legally qualified, in most instances, to practice the art of healing, has been willing to work a credulous public in many instances for commercial purposes, and no very great effort has been made to get at the real value in these various methods.

Early in the war, the eau courant baths were introduced for therapeutic purposes, and these were rapidly followed among all the allied nations by elaborate equipment for hydrotherapy, electrotherapy, thermo-therapy, mechano-therapy and massage. To these were added gymnasia and workshops of various sorts for therapeutic and occupational purposes.

Those of us who had the opportunity of four years' of service have had the advantage of watching the effect of these varied agencies in the treatment of medical and surgical conditions from a clinical standpoint.

That the results have not been as good as some of the enthu-

siastic supporters of those methods had hoped, is certain, but that they had, outside of the psychological effect, some beneficial effect is equally certain.

It surely remains for us in these post-bellum days to sit down quietly and make an estimate of these values, separate the wheat from the chaff, and save the grain of truth for future work.

Ample opportunities should be forthcoming from industrial surgical conditions and from convalescent medical conditions to make use of these beneficial agencies. In addition to a canvass of the clinical values a great opportunity is ours, by means of laboratory research, to investigate the scientific values of these "therapies" and put them on a scientific foundation.

In the field of hydrotherapeutics a problem necessary to be solved is whether the entire value is due to heat, whether any virtue, aside from the psychic, is added in the running water, or the forced aerated baths, or whether these factors simply tend to displace that layer of air which apparently exists between the water and the limb and permits of closer application of the heat.

The effect of the heat upon the rapidity of blood flow through the tissues, the depth of penetration of this heat, not only moist heat but other forms of heat, such as dry or radiant heat, diathermy, etc., the transient or lasting character of these effects are all problems for research and solution.

In a similar way, the investigation of the effects of electric currents on normal and pathological tissues, and, in cases of injuries to nerves, the effects on normal denervated muscles.

The effects of ionization with various chemical agencies, on normal and pathological tissue is necessary, to prove whether anything of value can be hoped for from this line of treatment.

Only a suggestion of the various lines of research open to us can be here touched upon, but it is hoped that it will be sufficient to stimulate the interest of our members and that we may hope that the future will see the solution of many of these problems by our interested members.

Already, through a grant given by the Canadian Government through the Department of Militia and Defence, we have a Research Committee, of which your president is Chairman, working at a number of these problems, and some progress has been made toward a solution of some of them. It is hoped that even

after the demobilization of our expeditionary force this Committee may be continued by the Department of Federal Health.

When these therapeutic agencies have been foundationed, from a clinical and experimental standpoint, then the Medical Colleges should undertake to instruct all students of their values and methods of administration. In Hospitals there should exist sufficient equipment to carry out these methods, and there, technicians should be trained who, under the direction of medical men, could administer these forms of treatment so that the suffering public could be assured of the best that could be obtained in these lines, and to the same extent discourage unqualified men from practicing them.

If in addition to this, our legislatures should enact legislation requiring all and sundry chiropractors, osteopaths, Christian scientists, and various other healers to conform to our standard of educational entrance for matriculation, and take the preliminary training demanded by our Medical Colleges before they should be qualified to practice, the difficulty of the unqualified man in the community would be largely solved and the public protected.

Occupational therapeutics for bed-ridden patients undoubtedly plays an important part in keeping up the morale of those who are confined to bed for some considerable time. Basket making, bead work and even fancy needlework can be readily learned even by men, and serve to pass the time.

For the patients who are able to be up and about, however, this form of pastime is not to be recommended, as it tends to lower the morale and leads to hospitalism.

The consensus of opinion among our medical officers is that as soon as possible active exercise and work should be substituted for the passive movements and massage.

The workshops have been an excellent means of getting this type of treatment. The work is primarily therapeutic and if it can be made the starting point for a vocational training course so much the better. The various workshop activities include wood working in all lines, sheet metal and machine shop work, printing, boot making and repairing, draughting, electrical wiring and others.

The encouragement men get by finding out that they are not derelicts but can do in various lines very creditable work, is ex-

ceedingly great, and many a man is rescued from the verge of despair and brought back to an interest in life and citizenship.

The gymnasium similarly is a most useful therapeutic adjunct, and it is easily demonstrated that a short active treatment in gymnastics and organized games does much to assist the return of function. Too much emphasis cannot be placed on this feature of the work, and in the future the active treatment should be made to serve a greater purpose than hitherto.

THE OPEN OPERATION FOR CONGENITAL DISLOCATION OF THE HIP

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(Read at the Annual Meeting of the American Orthopaedic Association, at Toronto, June 1920.)

It is said that "traditions die hard," and those associated with surgery are no exception to the rule. The tradition that congenital dislocation of the hip should be treated, not by open operation, but by one of the various so-called "bloodless" manipulative methods, continues to manifest an extraordinary degree of vitality, notwithstanding the fact that such methods are blind, irrational and deplorably uncertain in results.

Twenty-five years ago congenital dislocation of the hip was regarded on this continent as practically incurable. In Europe considerable operative work had been done in this field by a handful of pioneers, and in America Phelps and a few others, following the lead of European surgeons, were performing open operations, the chief feature of which was the ruthless scooping out of the shallow acetabulum. The stiff and functionally unsatisfactory limbs which often followed these operations, together with the appreciable danger which attended them, did not appeal strongly to most workers in the orthopaedic field; and even if the results had been much better, the open operation would hardly have become generally popular with the orthopaedic surgeons of that time, most of whom had been trained much more thoroughly in mechanical than in major operative surgery.

Rumors that Lorenz of Vienna had perfected a method of bloodless reduction had crossed the Atlantic, and when this surgeon visited America and gave his seductive demonstrations the keenest interest was aroused, and our orthopaedic specialists set resolutely to work to remove the reproach of incurability which clung to this deformity. As has often happened before, zeal outran judgment, and patients who were too old, or who, because of unfavorable anatomical conditions were unsuitable subjects for the operation, were subjected to the most severe manipulations, often with doubtful benefit and sometimes with disastrous results.

About one year after the visit of Lorenz, the late Dr. H. Augustus Wilson presented to the American Orthopaedic Association at Philadelphia a series of cases treated by manipulation, some of which had been operated upon by Lorenz himself, and others by Wilson and his assistants following the Lorenz method. It is not unfair to state that the average result in these cases was not such as to arouse enthusiasm. Notwithstanding the variable results secured by manipulative reduction since that time, this method continues to be the routine treatment for this disability.

At the eighteenth annual meeting of the American Orthopaedic Association at Atlantic City in June, 1904, Dr. Harry M. Sherman of San Francisco read a remarkable paper in which he advanced what seemed to me an unanswerable line of argument opposing manipulative reduction, and favouring arthrotomy as the routine treatment. Dr. Sherman's paper must be read to be fully appreciated, and I can review only a few of its outstanding features. Disgusted with the downright failures and fictitious successes of the manipulative method, he definitely abandoned it in 1898, and with one exception performed arthrotomy in all subsequent cases up to the time his paper was presented six years later.

Dr. Sherman's line of reasoning cannot be improved upon, and inasmuch as my experience has placed me in complete sympathy with his conclusions, I wish to quote from his paper at some length. He says:

"As regards the manipulative method, I am sure that Lorenz told the whole truth when he stated that the obstacle to reduction was the narrowed part of the capsule at the posterior and superior, or superior part of the acetabular rim. If the opening at this narrowed part is big enough to permit the head to pass, reduction can be accomplished by manipulation, and may be maintained if the acetabulum is deep enough. I have in two instances done this, I know. But in the twenty-eight hips in which I have done arthrotomy, and in which I have explored the narrow part of the capsule by my finger, and so know its size and the strength of its walls, there has been but one case in which the passage of the head would have been possible. I am not too dogmatic when I say that no possible force could have put the femoral head through the narrow part of the capsule in any of the other cases. One possibility and twenty-seven impossibilities!

"Now what happens when attempts are made to accomplish this impossibility? Lorenz has reported plenty of fractures of the femur and one each of the pubis and of the ilium, and other operators have done the same.

(Davis: Am. Jour. Ortho. Surg., Feb., 1904.) Lorenz reports seven cases of paralysis out of 400 odd operations, but Taylor, (Am. Jour. Ortho. Surg., Feb., 1904) looking carefully for the condition, finds 11 cases in less than 50 operations, by various operators, including, I believe, Lorenz himself. While Taylor states that most of these cases recover, the uncertainty of the result is patent to all who have had the misfortune to injure a few major peripheral nerves. It surely is an accident that cannot be disregarded. My own contribution to the casualty list is the report of a case of Lorenz' own, of rupture of the capsule of the hip joint, distal to the constriction, and the thrusting of the femoral head out among the muscles of the thigh. While only one case was shown to have had this accident, still, from the similarity of the clinical conditions, I believe another had it, and it is not in the least impossible or improbable that it occurs in very many cases, especially in the class called 'anterior transposition.' Finally, on all sides one finds the absurdity of the term 'bloodless" pointed out and the reference to the lacerations of the muscles, the extravasations of blood and hematomas. And, last of all Lorenz has reported one case of gangrene of the whole lower extremity.

"These accidents must make anyone who is not an enthusiast, or a special pleader, stop and think. One must say that to justify the exposure to such risks the percentage of successes, anatomic and functional, must be high, so that the benefit may, in the opinion of all, outrank the possible harm.

"What is the percentage of successes?

"From what we have seen of the Lorenz results, scattered between Boston and San Francisco, we cannot believe that he ever really got good anatomic results in about half of all his cases. I am told that Wolff's claim was for only 25 per cent. of anatomic repositions, and Ridlon, in the most recent pronunciamento, claims only 10 per cent. though he hints at 20 per cent. Is this enough?

"One hundred children out of one hundred are exposed to fractured bones, injured nerves, lacerated muscles, torn capsules and ruptured blood-vessels.

"Ten out of one hundred may expect to get the prize sought.

"Sixty out of one hundred may get the doubtfully 'good result' of an anterior transposition.

"Thirty children out of the hundred are perhaps to be considered fortunate if they get nothing.

"In all seriousness I declare that the percentage of successes is not enough to warrant the risk; and personally I claim that the percentage of successes is not enough to justify the method apart from the risk."

Before hearing Dr. Sherman's paper I had carefully tried out various methods of manipulative reduction, at first following the Lorenz technique—as I had seen him practice it—with scrupulous attention to every detail; and later introducing such modifications and improvements as my own experience and that of some of my colleagues of the American Orthopaedic Association had shown to be desirable.

Immediately after my return from Boston, where I had gone to see Lorenz operate, I had a female patient of three years with congenital dislocation of both hips, and a true anatomical reduction was easily effected on both sides; the patient was perfectly cured and remained so. This naturally made me at once an enthusiastic disciple of Lorenz, but unfortunately subsequent experience was far less satisfactory and I can only recall a couple of other cases in my practice where a true anatomical cure was secured by this method.

After hearing Dr. Sherman's paper I began to try out cautiously the open operation in selected cases, and finally, a number of years ago, abandoned the manipulative method altogether. Without attempting to explain the large percentage of cures claimed by some advocates of the manipulative method, I wish to say that my experience abundantly confirms Dr. Sherman's contention regarding the practical impossibility in most cases of passing the head through the constricted portion of the capsule. Very exceptionally, in the youngest patients, this can be accomplished, but in the hips I have opened it was clearly a physical impossibility in at least ninety-five per cent. After making a free opening in the capsule and flexing the thigh, the tip of the index finger can readily find the shallow acetabulum covered in, except a small portion at its upper, or upper and back part, by a wall of capsule. The upper limit of this wall is felt as a well defined border past which only the tip of the index finger will ordinarily go. To anyone who has become familiar with the sensation of "hour-glass" constriction imparted to the finger, the absurdity of attempting to find and pass this minute aperture without opening the hip seems beyond argument. Only after the constriction has been freely relieved by the knife can the head really be placed in the acetabulum.

How is the popularity of the so-called "bloodless" method of reduction to be explained? It must be admitted that manipulative reduction has for more than two decades been the routine treatment of this deformity, and there is little to suggest that the members of the American Orthopædic Association, who treat most of the cases on this continent, are prepared to abandon this method in favour of the cutting operation. In answering this question it is only necessary to bear in mind a few facts. Before the introduction of the manipulative method, congenital dislocation of the

hip was an incurable affection—most cases after being diagnosed, were simply dismissed. To be able actually to cure a small proportion of cases, and to bring about distinct functional improvement by anterior transposition in a very considerable number of others, without resort to the knife, was under these circumstances a rich find. Happiness being relative, the orthopædic surgeon who had discovered a kind of half cure for a condition before which he formerly stood helpless and humiliated, was naturally elated, and the manipulative method was practised with a will and energetic efforts were put forth to improve it; if results were not always ideal, the surgeon at least had the satisfaction of knowing that he had followed orthodox surgical practice and that no one else could show a larger proportion of successes.

Most of us prefer a known to an unknown path, especially in responsible surgical procedures where a false step may be disastrous to the patient; and the manipulative method has been followed so universally that few have gained a large measure of practical acquaintance with the open operation: In a word, the open method has been left almost without either teachers or students. The result is that today to most orthopædic surgeons the open operation remains an uncharted sea full of uncertainties and imaginary dangers.

My own first attempts were made with no little misgiving, but confidence has come as experience has increased; the difficulties to be expected can now be forecasted with reasonable assurance, and the kind of operation most suitable at different ages can be determined in advance with tolerable certainty. In short, my experience has so far crystalized that I now find myself able to lay down certain general rules for my own guidance in the management of these cases as they come to me at all ages from infancy to adult life. These principles I shall endeavor to lay before you.

1. All cases should be treated by open operation, never by manipulation alone. This rule is subject to possible modification, should the claim recently put forth by Henry W. Frauenthal of New York, and published in the Journal of the American Medical Association on January 10th, 1920 be sustained by future experience. Frauenthal claims to have discovered, accidentally, that in children up to two and a half years of age the dislocation can be reduced by manipulation without an anæsthetic, and will re-

main reduced, in nearly all cases, without applying the usual plaster-of-Paris fixation, the child being allowed to go about at once without restriction. This sounds too good to be true, but one must be sufficiently open-minded to await further evidence regarding such an extraordinary claim when put forward seriously.

2. The common teaching that the open operation should be reserved for cases where treatment by manipulation has failed, is in my opinion both wrong and mischievous, notwithstanding the fact that so high an authority as Mr. A. H. Tubby has, in a recent excellent article in the Lancet reiterated this teaching. With the possible exception of the cases suitable for Frauenthal's manipulative reduction without anæsthesia, the open operation should be performed without previously trying the manipulative reduction, or at any rate, only such gentle manipulations as will do no damage to the tissues in the event of failure, should be attempted. If one believes that it is nearly always a physical impossibility to pass the head through the constricted part of the capsule without enlarging the opening with the knife, then it is irrational to damage the tissues by a blind manipulation foredoomed to failure. Especially is this true when attempts at manipulative reduction are carried to such extremes as are described in Mr. Tubby's paper. He says:

"No matter what the age of the patient may be, no resort is made to open operation until every effort has been made to reduce the dislocation by the manipulative methods. In one instance, no less than eight such unsuccessful attempts were made, and only then was I compelled to devise this new method of operation. Portions of the adductors had been exsected, extension had been tried by heavy weights for several weeks, traction by pulleys up to the danger point had been used; and even when the trochanter major had been pulled down one inch below its normal position we found that flexion, hyper-extension, abduction, circumduction inwards and outwards were all unsuccessful."

Such a statement coming from a surgeon of Mr. Tubby's ability and experience reveals in a striking manner how powerful is the grip with which traditional teaching holds the profession in regard to this particular surgical condition. Such persistent unsuccessful efforts accomplish no good and they do great harm, for scarred and bruised tissues of lessened resisting power to infection do not afford the most inviting field for a subsequent cutting operation, and cannot function as perfectly after the operation as tissues which have not been treated so unkindly.

3. The best age for the open operation is between two and three years. The difficulty of keeping the plaster dressing from being soiled introduces unnecessary complications if one attempts to operate before the child has been taught to indicate when evacuation of the bladder or bowels is desired.

4. For this operation there are two main paths of approach to the hip joint,—the anterior and the posterior. For most children under six the anterior incision affords the best approach to the joint; but in older patients, or in any case where exceptional difficulty is anticipated, the posterior route offers certain advantages. Exceptionally, when the head is high above the acetabulum and unusually difficult to draw down, the posterior route may be used even in young children; vice versa, a very loose hip, in which the head can be brought near the acetabulum by manual traction, may be attacked successfully by the anterior incision at any age. I have been conscious for some time past of an increasing fondness for the anterior route, and since reading Mr. Tubby's paper, (which did not come to my notice until the paper I am now presenting was practically completed), I feel certain that the anterior incision is likely to find more and more favour in my own practice. Mr. Tubby's paper has convinced me that in my own operations sufficient conscious attention has not been paid to the part played by the iliopsoas and that by dealing deliberately with this resisting structure, as described by him, instead of dividing it only incidentally and perhaps imperfectly while relieving the constriction in the capsule, the scope of the anterior approach to the joint may be extended very considerably.

5. In single dislocations there is practically no age limit to treatment by open operation; a stable hip, but one with limited mobility, can always be secured even after full adult life has been reached, though not a true reduction such as is possible at an earlier age. Even in adults with double dislocation, if there is much disability, at least one hip should be stabilized; neither hip should be subjected to operation if the disability is small. The correction of the extreme lordosis which is present in adult patients is in itself well worth while, even if accomplished at the expense of ankylosing one hip, for it delivers the patient from a constant mechanical strain. If but one hip be dislocated the lordosis disappears; but even if the dislocation be double and only one side is submitted to operation, the improvement as regards

lordosis and the increased mechanical security will be much appreciated by the patient.

6. In double dislocations in children both hips should never be operated on at one time; my usual practice is to allow an interval of from six to eight weeks to elapse between the two operations; and if the operation has been unusually difficult, so that there is reason to fear great limitation of movement, it may be well to allow several months, or even a year, to elapse between the two operations so that the ultimate effect of the first operation can be fully estimated.

DESCRIPTION OF THE OPERATION

The Anterior Route: In operating by the anterior incision my technique has followed closely that described by Dr. Sherman, except that the upper part of the incision is extended backwards, and I have never performed a subsequent osteotomy to overcome torsion deformity as recommended by Dr. Sherman in his second paper. An incision about four inches in length is made in the long axis of the limb, beginning just below the anterior superior spine; the upper part of this incision is extended backwards a couple of inches just below the crest of the ilium. After dividing the deep fascia the interval between the tensor fasciae femoris and the rectus femoris is easily found, and these muscles are separated and held aside by retractors. Then the muscular tissues exposed along the front part of the crest of the ilium is divided, (origin of tensor fasciæ femoris and anterior fibres of gluteus minimus), giving a wide exposure of the field of operation. By rotating the limb outward and inward the head can be easily felt and is exposed by incising the capsule in the same direction as the vertical portion of the external incision. Mr. Tubby recommends that the capsule be opened by a crucial incision, and this may possibly have certain advantages. With the thigh slightly flexed, the right index finger thrust into the wound will find the acetabulum and recognize the constricted opening already referred to. A blunt pointed hernia knife, held in the left hand, is then guided cautiously along the palmar surface of the right index finger into the acetabulum above the constriction; the knife is introduced with its flat surface resting against the right index finger, then by rotating the handle with the left hand the edge is

brought into contact with the constriction which is then freely divided in a downward, or downward and slightly backward direction, thus avoiding risk to the femoral vessels. If this part of the operation be well performed, on withdrawing the knife it will be found that the entrance to the acetabulum is now free, and by using deep retractors the acetabulum can often be clearly seen if the light is good. No exact routine manipulation is used to place the head in the socket; the best way to accomplish the desired end will readily suggest itself and in very young children it is accomplished with great ease. Usually the thigh is flexed to a varying degree, and then a combined abducting, rotatory and lifting movment, with or without external pressure on the trochanter, will usually cause the head to slip into the acetabulum without difficulty; the chief requisite in effecting reduction is to have a clear mental picture of the effect of various manipulations on the direction of the head. A gouge chisel, with a blunt rounded edge, introduced into the acetabulum is useful in nearly all cases, in fact in all but the youngest children it is almost essential; not only does it serve as a guide and lever on the same principle as a shoe-horn, but also acts as a retractor and speculum. Ordinarily, after having effected reduction one re-dislocates once or twice so as to test for the position of greatest stability; having ascertained this an assistant is given the responsibility of maintaining the desired position during the closure of the wound and the application of the dressing and plaster. Usually full extension of the thigh, 25° of flexion of the knee, 40° to 60° of abduction, and slight or pronounced internal rotation will meet the requirements. The deep part of the wound is quickly closed with a continuous suture of plain catgut, and the skin with silkworm gut. No attempt is made to effect accurate repair of the capsule; after the head had been placed in the acetabulum the tissues fall together more or less naturally and closure of the deep part of the wound is an easy matter.

The first dressing is usually left undisturbed for a month or six weeks. If thought desirable the stitches can be removed in a week or ten days through a window cut in the plaster. When the second plaster is applied at the end of about six weeks the abduction and internal rotation are diminished, and as the second plaster is not carried below the knee, the child is now encouraged to bear weight on the limb. A third and even fourth dress-

ing may be applied at intervals of a couple of months, the degree of abduction being diminished at each successive dressing.

The Posterior Route: When operating by the posterior route the joint is approached through a Kocher incision from five to eight inches in length, according to the size of the patient. The upper part of the incision extends from the upper border of the trochanter in a direction corresponding roughly to the fibres of the gluteus maximus, and the lower half follows the long axis of the limb along the outer side of the femur. Having divided the fascia and exposed the upper part of the vastus externus and the insertion of the gluteus medius, an incision is then carried to the bone, extending obliquely from the upper angle of the trochanter posteriorly downwards and forwards to its anterior border, following the line of the insertion of the gluteus medius; then, by keeping the knife close to the bone the upper part of the trochanter is quickly denuded of all its muscular attachments. The fibres of the gluteus maximus are easily separated in the line of the upper limb of the skin incision; this exposes the capsule which is then opened along the upper border of the head and neck. It may also be necessary to make a more or less complete circumferential detachment of the capsule from the outer part of the neck.

It will now be easy to locate the acetabulum, which is usually shallow. In older patients it may be necessary to clear it with a curette, or even to deepen it, but such procedures should be avoided as far as possible as it is desirable to keep the cartilaginous lining of the cavity uninjured.

The really difficult part of the operation now begins, viz. reduction of the dislocation. The head is often so high above the acetabulum that reduction seems impossible. Strong traction applied to the limb may fail to diminish the distance appreciably. As the operation by the posterior route is usually reserved for older patients in whom we expect difficulty in effecting reduction, it is usually advisable to do a free tenotomy of the adductors, just before beginning exposure of the hip region, so as to diminish resistance to the descent of the head. It is not necessary to divide either the rectus or the hamstrings, as these are easily relaxed by flexing the thigh and knee.

It has been suggested not only to perform various tenotomies, but also to apply powerful weight traction for several weeks be-

fore doing the operation proper; trial of this preliminary traction has convinced me that it is practically useless and in my own practice it is no longer employed. A "shoe-horn" instrument of suitable width is practically indispensable. After trying various special instruments I have settled down to the use of a heavy carpenter's gouge, the cutting edge of which has been made blunt and the corners rounded. Passing this instrument between the head of the femur and the pelvis, this blunt rounded end is introduced as deeply as possible into the acetabulum. Strong traction is now applied to the limb by assistants who, by rotating the limb as instructed by the operator, cause the head to travel in any desired plane on its journey toward the acetabulum. By pressing strongly on the handle of the "shoe-horn" powerful leverage is applied to the head at the same time that the assistants continue their traction efforts; if need be tremendous force can be exerted, but care must be taken or the head may be badly crushed. After maintaining the effort for a brief period it is sometimes wise to desist for a moment or two and then repeat it, and by persevering it will be found quite frequently that reduction which at first seemed impossible will succeed after several trials. Sometimes, however, especially in older patients, reduction is obviously impossible. Under such circumstances the head and neck should be removed and the trochanter rounded off and an effort made to place it in the acetabulum. This will usually succeed, but in two patients, where the head was riding exceptionally high on the ilium and the resistance was unusually great, I found it necessary to remove not only the head and neck, but also about one inch of the upper extremity of the femur distal to the neck, before it became possible to implant the femur in the acetabulum. This sounds heroic, but the functional result in one case was excellent, (Case 2) in the other, (Case 6) the patient was 36 years old and as the operation was performed only a month ago, the result cannot yet be stated. Such free removal of bone may or may not be required in adult patients; it all depends on the height of the head above the acetabulum and the degree of resistance of the soft tissues. Exceptionally the acetabulum will be found so shallow that it must be deepened, especially at its upper part; I have found a sharp Jones gouge the best instrument for effecting this. Finally, in certain cases in adults it may appear desirable not merely to remove the head and neck

and shorten the trochanter, but also to denude the acetabulum of cartilage, even if it be not particularly shallow, this being done with the deliberate intention of bringing about bony ankylosis in the position of slight abduction. In single dislocations one should not hesitate to adopt such a procedure if reduction by less radical measures prove impossible. As has already been pointed out, such an operation must not be done on both sides in a case of double dislocation; but in properly selected double cases the patient's comfort and activity can be greatly promoted by doing this operation on one side; lordosis is greatly diminished, the patient suffers less pain in the back and gains a sense of comfortable mechanical security through having one strong pillar to take the bulk of the weight in standing.

Formerly, in adult patients where great disability existed, or the adducted position of the thighs formed an obstacle to marriage, I used to excise the head on both sides; but I now prefer, if reduction cannot be accomplished even after removal of the head and neck, to ankylose one side, and if necessary, in order to overcome adduction, to tenotomize the adductors and to remove the head on the opposite side.

Analysis of Results: In order to determine the results of the open operation in my practice, a careful analysis of case records has been made. With only a few exceptions these cases occurred in private practice; therefore it has been comparatively easy to keep in touch with them until final results were known.

These records show that I have opened the hip for congenital dislocation fifty times in thirty-seven patients. Seven of these operations in four patients are excluded from the final analysis because they were adults in whom nothing was attempted except removal of the head. As already intimated I have practically abandoned this operation. Three other operations were secondary attempts on hips I had opened before and which had become redislocated. These also will be excluded from the final summing up. Two other very recent cases are excluded because the result cannot yet be known.

This leaves a total of thirty-eight operations in thirty-one patients. The number is considerably smaller than I supposed when the preparation of this paper was decided upon, as I found on going through the records an unexpectedly large proportion

of cases where operation had been advised but refused. There were also a number of older patients whom I advised against any operation because at the time they consulted me my limited experience made me unwilling to accept the responsibility. In many of these, operation would now be undertaken without hesitation.

In attempting to present with perfect fairness the results of these thirty-eight operations, some unexpected difficulties were encountered. In such a matter it is not easy to exclude altogether the element of personal bias. Moreover, the interpretation of results in this class of cases is not as simple as it might seem, and independent observers might not be in perfect agreement in regard to the interpretation.

It was finally decided that the only reasonable plan of presentation was to classify all cases under four broad headings, and then make such qualifying comments as might seem necessary to a clear understanding. Following this plan the classification stands thus:

Cured, 12; good results, 14; failures, 6; doubtful, 6; total, 38.

In nearly all of the cases classified as "cured" the functional results were so good that in unilateral cases one hip was practically indistinguishable from the other. In a small proportion there remained a limitation of movement so slight as to be of no consequence, or perhaps an unimportant imperfection of gait that only critical observation could detect.

In the cases classified as "good results" there was wide variation in the anatomical conditions existing subsequent to operation. For example, in one bi-lateral case the X-Ray shows that the head is not in the acetabulum on either side, yet, beyond an appearance of increased breadth of the pelvis and a very slight roll in the gait which becomes less noticeable as the child grows older, there is little to suggest abnormality; abnormal lordosis has completely disappeared and stability is all that could be desired. In several of the cases under this heading there is marked limitation of movement, and in a few complete ankylosis. In two the radiograph shows the head apparently resting on the edge of the acetabulum; the relation looks precarious but there is perfect stability, and observation and radiographs continued over many months show no tendency for the femur to become displaced up-

wards. In every case classified as a "good result" the lordosis has been corrected and stability of the hip greatly improved; there is no doubt whatever as to the patient's condition being more satisfactory than before the operation.

Of the six operations classified under the heading "failures" one was in a child of four with double dislocation in whom, on both sides, the acetabulum was found so shallow that it was known before the operation was finished failure must result. This child was neither better nor worse. One patient, a boy of eight years, developed severe typhoid fever shortly after the operation, and it became necessary to remove the plaster dressing; the final condition of this patient's hip was rather worse than before the operation. In one patient, (Case 1), the operation resulted fatally under circumstances so unusual that I felt justified in concluding that the fatal outcome could not fairly be attributed to any defect in the operator's technique.

In the six cases classified under the heading "doubtful" sufficient time has not elapsed since operation to determine definitely the ultimate outcome; as far as I can forecast the future there will be in this group:—4 cures, 1 good result and 1 failure.

I feel it only reasonable to suggest that as a result of the experience already gained, future cases will show a larger percentage of cures than that now reported.

Wound Infection: In the fifty operations infection occurred six times; one of these was in the group of seven adults, in whom the head was removed on one or both sides and which are excluded from the final analysis. In this case everything went well for over two weeks, when the temperature became elevated and finally suppuration occurred on one side. This was attributed to chromic catgut; the ultimate result was just as good in this hip as on the other side which remained free from infection.

One case of infection occurred in the second operation, in the group of three hips operated on a second time because re-dislocation had occurred. The ultimate result in this case was such excellent function that the case is classed with the "good results," (Case 5).

This leaves four cases of infection in the thirty-six operations covered by the final analysis. In one of these, (Case 1.) the operation resulted fatally. In another, (Case 6.) the circum-

stances attending the case were peculiarly unfortunate, and the final condition of the patient was rather worse than before the operation.

Two other infections resulted in stiff hips, but in both of these the functional result was excellent.

REPORTS OF CASES

A complete table of all the cases operated upon would involve much useless and tiresome repetition; but a brief report of some of the more difficult and unusual cases may not be entirely without interest.

Case 1. This was the only fatal case in my series. E. M. N. age 6 yrs. 7 mos. female. Congenital dislocation of left hip. X-Ray showed an exceedingly shallow acetabulum and a deformed head. The parents were warned that the prospects for a successful reduction by the ordinary procedure were not promising, and they were willing to have the hip made stiff if this was unavoidable. The acetabulum was found to be very shallow and was deepened at its upper part; the dislocation was then reduced; the cartilage on the head of the femur was not disturbed; the usual dressing in plaster in the abducted position. On the following day the child developed a temperature of over 104 degrees, and in less than four days was dead of acute streptococcus poisoning. Upon investigation it was ascertained that in the same hospital three other cases of acute streptococcus infection had occurred within a week, only one patient surviving. The four operations were all different in character and were performed by different surgeons, all of whom were thoroughly competent men whose practice was limited to surgery. It was ascertained that one of the operating room nurses had a septic throat. No similar cases had occurred in this hospital for a long period before this fatal outbreak. I think it will be generally agreed that in this instance the fatal result was beyond my control.

Case 2. G. F. female, age 10 yrs. 10 mos. congenital dislocation of both hips. The hips were very high and did not yield under manual traction. The lordosis was extreme. It was decided to operate on one hip and observe the effect. Operation October 9th, 1919, Kocher incision as already described. It was found impossible to get the head into the acetabulum. The head and neck were removed and another effort made, but we were unable to get the

trochanter into the acetabulum. About one inch and a quarter of the great trochanter was cut away before it was possible to get the upper end of the femur into the socket. The limb was dressed in plaster in wide abduction. It was not disturbed for four weeks. When the plaster was taken off the joint was tender and any movement of the limb caused much discomfort. The child remained quietly in bed for a couple of weeks, but as neither tenderness nor abduction diminished to any large extent an anaesthetic was administered and the limb brought down parallel with its fellow and plaster again applied for three weeks. After removal of this dressing the patient was encouraged to move about, but for several weeks every movement was carefully guarded and she put weight on the limb very unwillingly. Gradual improvement occurred and the child left the hospital about the middle of February 1920. She was brought to my office for examination on March 1st, when the condition was found much more favorable than could reasonably have been expected. Lordosis was greatly diminished, there was a fair amount of movement at the hip and the limb that had been operated upon was almost two inches longer than its fellow, most of this lengthening being due to abduction. A cork-soled boot was provided for the other foot; when seen two weeks later she was becoming more and more active. Unrestricted functional use for several months will be allowed before deciding whether or not to operate on the other side.

Case 3. V. J. 11 yrs. female, congenital dislocation of right hip. Early in life received treatment by the "bloodless" method from a Chicago specialist. The shortening was more than usual. On the affected side the patient walked on the toes and latterly the lameness had increased. X-Ray showed an imperfect new acetabulum being developed above the old one. Operation September 28th, 1918, Kocher incision. The hip reduced with difficulty. The first plaster was removed December 18th and X-Ray picture taken which showed the head resting on the edge of the acetabulum. There was a fair amount of movement, but the limb was rotated externally and the knee could not be fully extended, the angle being about 150 degrees. The calf of the leg was slightly tender and numb, and remained in this condition for nearly a month, evidently the result of a slight traumatic neuritis; no motor paralysis was present. On December 20th, under anaesthesia, the limb was carefully manipulated so as to rotate it inward, and extend the knee.

A plaster spica was applied extending to the foot. The plaster was removed February 7th, 1919; patient was then given full freedom. Massage and gymnastic treatment commenced and continued for six weeks. Function improved progressively; the hip remained stable; shortening was entirely overcome. While movement was greatly restricted the improvement in her condition was so pronounced that both the patient and her friends were exceedingly well pleased.

Case 4. L. R. 6 yrs. female. Congenital dislocation of both hips with marked lordosis. X-Ray showed the acetabulum shallow and head poorly developed. Operation on right hip November 17th, 1917, anterior incision. Reduction effected with considerable difficulty. December 18th, 1917, plaster removed and X-Ray picture taken. This showed the head resting near the outer edge of the acetabulum. Plaster re-applied with limb well abducted. On March 5th, 1918 plaster removed and stereoscopic X-Ray picture taken which showed that re-dislocation had occurred, the head being above the acetabulum. A further operation was decided upon and was carried out on March 22nd, the hip being exposed through a Kocher incision. Reduction easily effected. Wound closed without drainage and the limb put up in plaster widely abducted. On April 8th plaster in neighborhood of wound trimmed away so as to permit removal of stitches. June 18th plaster removed and X-Ray picture taken. This showed the head in the acetabulum but it was not deeply embedded. Plaster re-applied with the limb moderately abducted and the child was encouraged to use the limb freely. September 24th plaster finally removed and the child given full liberty. X-Ray picture showed the head atrophied and in contact with the outer part of the acetabulum; limb stable and one inch longer than its fellow. Boot with thickened sole ordered for the other foot. February 8th, 1919, again examined and X-Ray picture taken. The relation of the femur to acetabulum had undergone very little change; the head seemed to be resting precariously near the edge of the acetabulum, but clinically it was secure and no slipping occurred under weight bearing. Movement was greatly restricted. The question of operating on the other hip now came up for consideration. It was felt that this involved considerable responsibility in case the second hip should become ankylosed or show greatly limited movement after operation, for of course two stiff hips would leave the child in a condition worse than the original one. It was finally decided that even if the second hip became

ankylosed the difficulty could be overcome by removing the head and neck of the bone. February 11, 1919. Operation on left hip today. Kocher incision. Head manipulated into acetabulum with considerable difficulty. February 28, 1919. Stitches removed without disturbing the main part of the plaster dressing. March 11, 1919: Plaster cut off to above the knee and patient encouraged to walk. March 28, 1919: Plaster removed. X-Ray showed head in acetabulum. Short plaster spica applied. June 4, 1919: Plaster finally removed and patient allowed full liberty. Treatment by radiant heat, massage and gentle manipulation was commenced. After three weeks hip was still very stiff, but patient was allowed to go home for three months. October 8, 1919: Condition greatly improved. Left hip (the second one operated upon) can be abducted and adducted appreciably. Flexion is limited to a few degrees. The femur does not slip upward under weight bearing. October 9, 1919: Anaesthetic administered. Without using any force the right hip moved much more freely than when patient was conscious, showing that the limitation of movement in this hip was due in part to muscular spasm. With the use of very little force it was easily flexed to a right angle, and in performing this manipulation some adhesions, not at all dense in character, could be felt giving way. Two days later the child was walking freely and seemed to have no discomfort as a result of the manipulation. October 15, 1919: Anaesthetic again administered, and the right limb was again moved freely; after which the child was allowed to return home with instructions to report in six months for further examination. It was thought better to postpone any attempts to increase the range of movement of the left hip by forcible manipulation until all possible improvement under ordinary functional use had first been secured.

Case 5. M. M., 13 years, 11 months, female. This patient was a stout well-developed girl with congenital dislocation of right hip. The actual shortening was only two inches, but practical shortening, due to adduction, four inches. The patient and her mother were informed that a stiff hip would probably result from the operation, but the lameness was so pronounced that they were both very willing to have anything done that gave a reasonable hope of improvement. Operation August 25, 1919, Kocher incision. Reduction effected with considerable difficulty. About ten days later patient thought she felt something slip out of place, and on remov-

ing the plaster and taking an X-Ray on September 11th the hip was found re-dislocated. I determined upon arthrodesis as the only sure way of overcoming the shortening and adduction. This was done on September 18th the head being placed in the acetabulum after removal of cartilage from both head and socket. Some infection of the wound occurred which delayed final healing but did no harm otherwise. In two months the patient was walking on crutches; these were discarded entirely two weeks later but a short plaster spica was kept on for four and a half months. At this time the hip was soundly ankylosed in a position of slight abduction and was painless. On March 15, 1920, her mother wrote saying that she was walking well with hardly a noticeable limp, and the patient herself and all of her friends were delighted with her improved condition. In this case I think a blunder was made in not including both thighs in the first plaster dressing. The patient was short and stout, and a single spica was not sufficient to maintain the requisite degree of abduction; I believe that this was responsible for the dislocation recurring after the first operation. By correcting this fault at the second operation reduction might have remained stable without deliberately seeking to bring about ankylosis by removal of the cartilage; but I was disinclined to take any chance of recurrence of the dislocation in connection with the second operation.

Case 5. G. W. 13 yrs. 11 mos. female. Congenital dislocation of left hip. Operation January 3rd, 1920, Kocher incision. The acetabulum found so triangular in shape that it was thought best to excavate its upper part with a gouge. The head was levered into position with very great difficulty after tenotomy of the adductor longus tendon. This girl was short and fairly fleshy. Bearing in mind my experience in Case 4, both thighs were included in the plaster dressing in a position of wide abduction. January 25th, 1920, plaster removed and re-applied as far as the knee, this being done on the affected side only. Hip was found in good condition and freely movable. Unfortunately considerable paralysis of both thigh and calf was found present, due to stretching of the nerves. Patient went home seven weeks after the operation and was told to move about as freely as possible, bearing weight on the limb and steadying herself with crutches, if necessary. This is the only case in my series where the operation produced any motor paralysis.

Case 6. A. K. 8 yrs. Congenital dislocation of right hip. In this case the operation was divided into two stages. At the first operation the adductors were freely divided after which powerful weight extension was applied for several weeks. On March 4th, 1918 the dislocation was reduced through an anterior incision. Reduction was difficult and considerable shock followed. Shortly after the operation he developed a severe attack of typhoid fever, and it became necessary to remove the plaster which allowed the dislocation to recur. He recovered after a tedious illness but the condition of his hip was rather worse than before operation.

Case 7. Mrs. J. 36 yrs. married. Congenital dislocation of left hip, with much shortening and lordosis. The patient was suffering increasing discomfort from backache. Operation May 7th, 1920. Kocher incision. Notwithstanding complete stripping of muscles from the trochanter, free separation of the capsule and complete division of the ilio-psoas, reduction was impossible. The head and neck were then removed, but still reduction could not be effected. Finally, one inch of the trochanter was removed and the upper and back part of the acetabulum slightly enlarged, after which reduction was comparatively easy, and remained stable with the limb moderately abducted. Both thighs were included in the plaster. No bad symptoms followed. The first plaster dressing is still in place and it is too early to speak of the result. Ankylosis with sufficient abduction to equalize the length of the limbs is expected.

Discussion

Dr. John Ridlon of Chicago: I have had a communication from Dr. Sherman with an X-ray of a case that he and I had and presented at the A. M. A. in San Francisco. I will read his letter for five minutes, and then take five minutes to discuss Dr. Galloway's paper, and five minutes for Dr. Adams' paper.

Letter From Harry M. Sherman, M. D., San Francisco, to Dr. John Ridlon

May 24th, 1920.

Once some six years ago, when I, in Chicago, saw you reduce the two hips of a congenital hip dislocation in a child, I asked you if you knew just where you put the femoral head, and you replied that you did not. Then I suggested that if it should be possible for us to be associated in a case, it would be good for you to make the reduction and for me then to make an incision and verify the new location of the head. This chanced to become possible, when you were good enough to come all the way to San Francisco to join me in an operation on a child whom I had at that time in the Chil-

dren's Hospital. The patient was a little girl about four years old, with a bi-lateral dislocation. Your comment on the condition as it was presented was this:

Doctor Ridlon's Comment

"Examination made on patient shows both hips dislocated backwards and upwards. The femoral heads cannot be felt in front on outward rotation.

X-ray shows right hip dislocated upward two and one-eighth inches; the left one two and a quarter. The right socket seems better than the left.

Operation by Dr. Ridlon

Patient anaesthetized, the right hip is fully flexed; thigh rotated somewhat inwards and then abducted; the femoral head passed into the socket after a minute or a minute and a half's effort. Socket felt very secure, and the replacement was secure and remained without being held.

Then I went to the left hip; replaced the hip with less difficulty and in less time than the right hip. The replacement was secure without being held, but the socket did not feel as perfect as the one on the right side. Both hips were put up by Dr. McChesney in plaster, the right one abducted with the outer side of the thigh posterior. The plaster was carried in both instances down on to the feet.

OPINION: Dr. Ridlon believes that both hips will give a perfect anatomical result.

Dr. Sherman's Comment

It was very evident from the position of the femoral head, directly under the femoral artery, that Dr. Ridlon had put the head into its proper location. With its reduction, all the tissues—muscular, vascular, fibrous and so on—passing from the pelvis to the femur, were tense, and with this tension on all sides of the femur it was kept as if by stays in the position in which Dr. Ridlon had left it. Under these circumstances, it would be quite impossible for me to make an incision which would permit the occular demonstration of the relation between the head and the acetabulum. After some hesitation, however, I made my usual incision between the long head of the rectus and the tensor vaginae femoris, and could then very easily pass my finger under the rectus and palpate the rim of the acetabulum and the femoral head. They could both be touched by the finger at the same time, the tip of the pulp of the finger being on the femoral head, and the middle of the pulp of the finger lying across the rim of the acetabulum. This palpation demonstrated the fact of the reposition. The question as to whether there was a folding-in of the capsule beneath the head, so that a double layer of capsule was between the cartilage of the head and that of the acetabulum was still, to a certain extent, an open one, and could be settled only by exploring the interior of the articulation. Therefore Dr. Ridlon re-luxated the head, bringing it to its usual dislocated position, and right underneath my incision. I made a cut partially through the capsule and then, having been up to this time, working on the wrong side of the table, I came round the table and cut definitely through the capsule in the proper way, and exposed the head.

When the hip was now flexed, relaxing the anterior portion of the capsule, it was very easy to pass the long blunt-pointed knife, and after it my finger, into the acetabulum, and practically no cutting was required to make way for the finger. Therefore it seemed that the opening in the capsule had been originally large enough for the head to pass

through, or that the opening had been enlarged by the head on its way to the acetabulum; and the former of these was the more likely, because when I opened the capsule there was no blood inside the joint.

With the conditions thus, it was not at all difficult to put the head again into the acetabulum, and the wound was closed and the limb dressed in the way common in these cases, well rotated-in and abducted 90 degrees.

There remains the question of the twist of the femur which exists in this child so that when the toes point forward the femoral heads look very much more forwards than inwards, so that the heads could only be expected to stay in the acetabulum if the toes were kept pointing inwards or a sub-trochanteric osteotomy were done, which would let the heads point inwards as the toes point forwards. That will be done on the right femur at the proper time."

The post-operative history of the child was no extraordinary one. At the end of three months I took the splints off to do the osteotomies which I had considered would be necessary, and at that time the right hip, in which both you and I were interested slipped out of place and I re-reduced it and put both hips back in splints in the original positions—yours in the Lorenz; mine in the Lange position. A month later I let the child go home, and she came to me now and again to have her plaster of Paris changed. In January, 1916, I sent you a photograph of the child, showing the limbs in the original positions—left, Lorenz; right, Lange. In May, 1916, in changing the splints I found a sub-luxation of the left head forward and upward, and it jumped backwards into the acetabulum as I flexed and adducted the thigh. This manipulation was in accordance with your request of February fifth.

My next memorandum of the child was on October 18th, 1916, when both hips were recorded as in place, the right a little deeper in the acetabulum; that the child was walking well, though with somewhat of a waddle.

In February, 1918, stable reduction and improvement in the use of the limbs is noted, and now in May, 1920, I see the child again and note normal use of the hips, and I am sending you the radiograms, showing that reduction in each instance is stable.

My comment on this would be that if everybody could reduce congenital dislocations **as you have done it in this case,** reduction through an incision would be unnecessary. In those cases where manipulative reduction is not accomplished or is impossible, the operation through an incision becomes of necessity the operation of choice.

You once told me that about 20% of your reduced hips became re-luxated. My experience shows that this re-luxation occurs because of a twist in the upper part of the shaft which swings the head and neck forward, so that they point forward when the toes point forward, and that they re-luxate because of this anterior twist. Therefore I think that the osteotomy which I have been doing and which untwists the twist and gives the head and neck the proper direction of inward and a little forward when the toes point forward, is something which should be done.

I am sending you this report and these comments, and at the same time

some radiograms showing the present condition of the hips. I had the child brought to me from Sacramento so as to have these radiograms and see her.

There having been a number of members of the Association at the Children's Hospital the morning that we did this piece of work, I wanted to report to them the success of your manipulative reduction. I did not, you may have noted in the memoranda, find it necessary to do the osteotomy in the case of this child. It was primarily a posterior location of the heads, and those cases do not as commonly require the osteotomy as do those which have the heads in anterior luxation from the beginning.

I am exceedingly sorry that I shall not be able to be in Toronto, but I shall hope to come East some time next summer and, if I possibly can, attend the meeting of the Orthopedic Association. It would be a very gracious thing if that meeting were put near that of the American Medical Association, so that those of us who have to come a long distance can attend both meetings on one trip." Signed: Harry M. Sherman.

Dr. John Ridlon of Chicago: I will talk first about Dr. Galloway's paper as that interests me more. He says that he considers bloodless reduction as a blind, irrational and unsurgical procedure, uncertain in result. I don't suppose that Dr. Galloway knows that his teaching is pernicious. He spoke of Dr. Lorenz coming here and getting us all interested. When Lorenz came here to operate I had operated on 32 hips and I knew how to put on plaster casts. In quoting "the latest pronunciemento from Ridlon" with 10 per cent good results I would say that that quotation was made by Sherman in 1898. As regards fractures occurring by bloodless manipulation, I fractured 5 myself between 1902 and 1904, and have had none since. My statistics were published by the Academy of Medicine in 1904, I have done a lot of work since then. I followed up Lorenz' cases done in Chicago and he had two perfect results. As to Frauenthal, I have not seen his work. Some years ago the New York Orthopaedic Hospital out of 4000 out-patients had 40 congenital hips. For the same year I operated on 41 hips in my private practice, I think I have had about 40 cases a year for 20 years. That experience counts for more than 31 operations. So much for Dr. Galloway's paper. In regard to Dr. Adams,—I have never had any cases of paralysis. As to anterior dislocation, I don't believe many of you know when you have anterior dislocation and when you don't, because I don't believe you know how to tell the relation of the head of the femur to the acetabulum. Most of you are satisfied to judge by the X-Ray. If the X-Ray shows the head away from the acetabulum, it is away, but if the X-Ray shows in, it may be just in front, and unless you know how to feel where the head is you don't know where it is. In some cases that haven't walked the head appears to be in the acetabulum. In cases of multiple congenital malformation the head of the femur is turned forward and lies in front. Heads are not so abnormal as the sockets. The socket always retains some abnormality even if the functional results are perfect. I had a case, a young woman of 20 years of age. I operated on her when she was 11 years old. At 20 you could not tell which hip had been operated upon. She had perfect normal function. The X-Ray showed an abnormal socket and head. As to torsion of the neck, I don't think any of you know anything about torsion of the neck, because you assume

that the head lies always in the same direction. If the dislocation is forward, the head must be twisted forward; if directly upwards, it is not twisted at all, unless upwards; if the dislocation is backwards, the head must be twisted backwards. Heads are not all twisted forward. The time to operate is when the shortening is from 1 to 1¼ inches. If the dislocation is ½ an inch you should not operate. If the child is strong you should not operate on a 2 inch dislocation. I had one case in Indiana, 10 years old. I worked an hour on a 2¼ inch dislocation, then I put in easily the other 2½ inch hip, the child finally walked without a limp, but with limited motion. In one case I did a 3¼ inch displacement for $500 as I needed the money at the time, but if it came now I would not try to do it for a million. As to Dr. Muller, the assistant of Lorenz, it has been the custom to erase any mention of him from the records of this society. Lange originated that position and Muller took the credit. We must know the reason for putting the plaster below the knee. It must be put on to prevent the leg from rotating outwards. But if the plaster is put on below the knee the child can't walk, and unless the child walks the head is likely to slip out when the plaster is removed, if you put plaster below the knee it must be cut after two months so that the child can walk. The reason you have so few good cases is because you keep the child in bed, unless the child walks the acetabulum cannot be deepened.

Dr. Walter G. Stern, Cleveland, Ohio. I am one of those who worked with Lorenz shortly after he definitely abandoned the open operation after performing it 250 times. The open operation was also abandoned by Hoffa, who had an experience of over 700 cases. The open operation was not abandoned without good reason by both of these authorities. They at least found the closed method not to be blind, irrational or unsurgical.

Lorenz' results in America in 1903 certainly should not be taken as a criterion of the efficacy of the closed operation: as you know, in the majority of places he worked under the most unfavorable conditions. For instance, in Philadelphia there was a great crowd in the operating room and doors and window sills crowded with physicians; the anesthetist in one case broke the chloroform bottle and had to fight his way out thru the crowd to procure a fresh supply of the anesthetic. Meanwhile the child was kicking and screaming on the table and Lorenz was trying to hold the replaced hip in its socket before putting on the cast. Another one of the Philadelphia cases left Philadelphia immediately after the cast was applied, and was not seen or heard from for another year. In Chicago people fell before him on their knees and begged him to operate on cases whether suitable or not. In the west he was met in the morning by a reception committee, taken to a hospital where he held a clinic, afterwards wined and dined for the rest of the day and then put on a train for his journey to the next town where the same thing was gone thru; and he never saw or heard of these cases again and certainly in the majority of cases the after care was not in the hands of those able to give the best care and attention necessary. I do not believe Lorenz or the method are clearly to blame for the bad results quoted in the paper.

Function and anatomical reposition do not go hand in hand and it is function that must be the measure of success and not the X-ray plates.

A number of years ago I tabulated the results in some 1500 bloodless operations, and found perfect function in 74 per cent of the cases; good in 13 and failure in 13. The statistics were not divided into uni-lateral and bilateral, and a bilateral case was considered a failure if both hips did not function properly.

The operative limits cannot be laid down in terms of years of life, but in terms of strength and resistance of the muscles about the hip. Dr. Jaeger will remember when he and I both assisted Lorenz in reducing the hip of a 26 year old Roumanian girl, which operation turned out to be a perfect functional success. My own oldest case was done when the girl was 13 years old, and we certainly have no cause to regret the results from this operation.

I do not believe that either Dr. Galloway or Dr. Sherman are justified in their deductions that since they usually find a constricted portion in the capsule of the joint, that the bloodless operation cannot succeed in placing the head into the acetabulum. One who knew nothing of the art of obstetrics might say, in finding the cervix undilated that the fetal head cannot get thru because the cervix was narrow and the head large. Practical experience has taught that the cervix will dilate, and likewise practical experience has taught those doing the bloodless operations who have had knowledge of the art of the open operations, that the bloodless operation was by far the most successful, not the few cases from one locality, but in the large majority of all cases the world over.

Dr. Albert Freiberg: I would like to speak on one or two points. It surely requires courage on the part of both speakers to have presented papers that differ from the views of orthopaedic surgeons all over the country, and with results so unfavorable as those of Dr. Adams. In the case of Dr. Galloway, the question is not whether he gets the head into the acetabulum, but whether he gets good final results. My experience has been that of Dr. Soutter. I want to consider secondary deformity and limited function after the head has been replaced. This has been emphasized by Legg in his mechanical theory of the so called Perthes or Legg disease. My own view is that this lesion is an infectious process. If traumatic, as in some cases, it should be the uniform sequel of manipulation where the force is considerable. When infection happens it probably does so because the child has infectious foci somewhere else in the body. In my cases to be operated upon bloodlessly (and they will continue to have that operation) I shall continue to have removed diseased tonsils or teeth where found before hand. I have not done that long enough to say whether I shall succeed in preventing subsequent deformity.

Dr. John L. Porter: The trouble with many speakers is that, as in religion, they want to stick to their own dogma, and there is no middle ground where they can meet and come to some agreement. I don't believe that every dislocation of the hip can be reduced by bloodless operation, or that everyone needs open operation. We have considerable disagreement as to how we should treat these cases. There are good grounds for disagreement. I think it is clear that it is necessary to get together a committee to work out the statistical facts just as we had a committee to settle the scoliosis question. It results in considerable advantage. I think when we have operative procedure backed up by a man like Galloway, we should consider his views. I reduced a case in a girl 15 years old, very easily, in 5 minutes.

Dr. Freiberg: What was the end result?

Dr. Porter: That is just what I am going to tell you; it was very bad. The limit of motion got less and less and the hip is nearly stiff. This entire matter should be thoroughly investigated. Something more should be done than to let Galloway read this paper and let another man get up and say Galloway does not know what he is talking about. That does not get any practical result.

Dr. Geo. B. Packard: About three years ago I reported sixty cases of congenital dislocation. The results in the single cases showed 85% very satisfactory. In the double cases there were more anterior transpositions but these were quite satisfactory. I had a few cases of paralysis which were due to the high position of the head—about 2 inches above the acetabulum. I can see no reason why paralysis would not occur in such cases in the open operation.

Dr. Galloway, closing: If I may judge by the trend of the discussion, my conclusions are not unanimously approved. I have only two or three things to say. I think Dr. Sherman was correct when he said that if all cases of congenital dislocation could be reduced as successfully as the case of his treated by Dr. Ridlon, they should be so treated; but I don't think such results are the rule. I am sure that Dr. Ridlon knows more about bloodless reduction than I do; no one in America has had more successful experience than he has had. I have had a few successful, but may unsuccessful cases. If some of the things that I have said will lead to a more favorable consideration of the open operation I shall be well satisfied. It is generally agreed that the bloodless operation becomes more uncertain of result, the older the patient, but many of the older cases can be greatly benefited by open operation. In regard to torsion of the neck,—Dr. Ridlon's statement is purely theoretical. In operating I have always seen a forward twist, but never backward. I can't agree that the results of Lorenz in this country were not a criterion; if he operated on unsuitable cases, he was at fault. His results should be taken as more or less representative.

THE VARIATIONS IN THE ANATOMIC STRUCTURE OF THE LUMBAR SPINE

BY JOEL E. GOLDTHWAIT, M. D., BOSTON

The following communication is made for the purpose of emphasizing the variations in the structure of the lumbar spine, and the importance of the study of this region with reference to such variations, for the explanation of the symptoms of many of the cases of back ache or leg pains.

The communication consists almost wholly of illustrations made from X-Ray negatives which are offered as the basis of study of other cases. The history of the patients from whom the negatives were made is not given in detail, but it should be remembered that all of these patients sought treatment for the relief of pains in the back or in the legs. In the illustrations not only is the low lumbar region shown, about which considerable has been written in connection with back pains, but the dorso-lumbar region as well. The reason for this is that the many patients suffering from pain in the low back, not due to disease conditions, refer the pain commonly to two regions; one being the very low back covering the lumbo-sacral and the sacro-iliac joints, and the other being the dorso-lumbar juncture over the areas that would be represented by the end of the transverse processes of the first lumbar. The anatomic study has usually indicated the reason for the pain, and while the peculiarities in structure and mechanics in the lumbo-sacral region have been discussed more or less of late, very little attention has been given to the conditions as they exist at the dorso-lumbar region. In this latter location the pain is often a dull and heavy ache, but at times is exceedingly acute, with the body listed to one side and held very rigidly by muscular spasm. From the location of the pain it is often supposed to be due to some disturbance of the kidney, but is commonly relieved, at times instantaneously, by manipulation that would relieve pressure of the last rib against the tip of the transverse process of the first lumbar vertebra. At times the rib apparently gets caught behind this process with intense pain due to the direct pressure of the intercostal nerve or to the irritation of the ganglia that lie in front of these ribs. The fact that the rib can get into a position behind the transverse process of the vertebra below is easily

FIGURE 1

In size and general shape of the bodies of the lumbar vertebrae, the shape and size of the sacrum as well as the position of the sacrum with reference to the crests of the ilia and the size and shape of the lower ribs, the above illustration is practically in keeping with the text book normal. The transverse processes are somewhat longer than is supposed to be normal, especially as they appear upon the third lumbar vertebra. There is distinct over-riding of the spinous processes of the 3rd, 4th and 5th vertebrae, which is undoubtedly responsible at least in part for the rotation of the spine here present. The downward inclination of the last ribs, together with the long transverse processes, would make it very easy with the patient in the upright position for the intercostal nerve of the last rib to be caught upon or press against the transverse process.

FIGURE 2

The first four lumbar vertebrae are of the text book normal, and the transverse processes are of the so-called normal length. The last lumbar vertebra in the above illustration shows a distinct articulation upon the left between the large broadly formed transverse process and the top of the sacrum. This shows a large process upon the right side, but with distinct space between the sacrum and the process, in which on the basis of a large number of dissections, undoubtedly a bursa lies, the irritation of which is many times responsible for the pain present in these cases. The bifid condition of the spine at the last lumbar is clearly shown. The case also shows the rudimentary last rib with a somewhat different inclination than is shown in some of the other illustrations.

FIGURE 3

A spine of the slender anatomic type, showing the narrow lateral width of the vertebrae, with the greater proportionate thickness measured in the long axis of the body. The length of the loin is to be explained in this way. The transverse processes are long and slender with the rudimentary 12th rib showing with more marked formation upon the left side than upon the right. The ribs as a whole are of the slender type, with the narrow neck close to the head of the rib near the spine. The crescentic articulations with the vertical axes are clearly shown in the four upper lumbar vertebrae.

FIGURE 4

Spine of an individual of heavy ana omic type with four lumbar vertebrae showing the greater lateral breadth of the bodies of the vertebra than is peculiar to the text book normal, with the lessened proportionate thickness of the vertebra measured in the lost axis of the body. The transverse processes are short and strong. The spinous processes are strongly formed, the tip of several is broadened to over-ride the process below and the processes are in such close contact that very slight backward bending would be possible. The articular processes are crescentic with vertical axes and naturally allow very little lateral bending of the body. The last ribs are very long and of the heavy type of structure. The sacrum is placed low between the ilia as it frequently is in the heavy anatomic type.

FIGURE 5

A spine of the heavy anatomic type with four lumbar vertebrae with partial lumbalization of the upper sacral segment. Note the strongly formed and horizontally placed last ribs. Contrast the length with those of Figure 4.

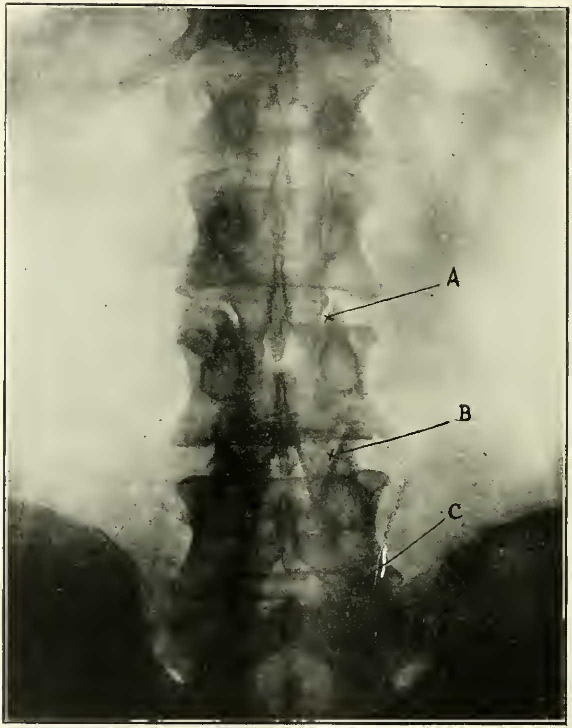

FIGURE 6

A spine of the heavy anatomic type with the sacrum set well below the crests of the ilia with the last lumbar vertebra much lower than is normal. The relatively short torso of the patient pictured above is due not to a smaller number of lumbar vertebrae but to the fact that the last lumbar vertebra is entirely below the level considered normal according to the text books of anatomy. The possibility of impingement between the transverse processes of the last lumbar to the wings of the ilia must be obvious. In this case also the last ribs are short and relatively straight out at the side so that the possibility of the pressure of the 11th rib against the tip of the 12th rib wih resulting pain at the point, is obvious. The crescentic articulations (A. B. C.) in these vertebrae are clearly shown but from the second to the fifth vertebrae the articulations are much more oblique than is normal, see Figures 2, 3 and 4, with a natural influence upon the mobility of the spine.

FIGURE 7

A spine of the heavy anatomic type with the broad relatively thin lumbar vertebra. Note the strong, heavily formed and horizontally placed lower ribs, with the left one so placed that with very little downward displacement of the 11th rib on that side, pressure upon the intercostal nerve at that point could easily be made. This case also illustrates the very narrow sacrum in contrast to Figure 1 or Figure 8.

FIGURE 8

The first four lumbar vertebra have the characteristics of the text book normal. At times the last lumbar vertebra is a mere narrow circular ring with almost no body to the vertebra present. The above illustration shows one of these conditions showing it rather imperfectly, but a condition which has been checked up by many plates which show only a rudimentary ring entirely detached from the sacrum, with a true articulation with the fourth lumbar vertebra. The ribs in the above illustration are distinctly in keeping with the structure of the slender anatomic type, and are a marked contrast to the shape and size of the ribs in Figure 4 and Figure 9.

FIGURE 9

The six lumbar vertebrae in the above illustration are of the broad and thin type with the crescentic articulations closely locked which makes lateral mobility of this type of spine difficult. The long last ribs with the narrow neck are characteristic of the slender anatomic type and the downward displacement naturally results in forcing the diaphragm and the viscera downward, especially in the upright position, condition which must be aggravated when the ribs are as long, with tight clothing worn over the upper abdomen.

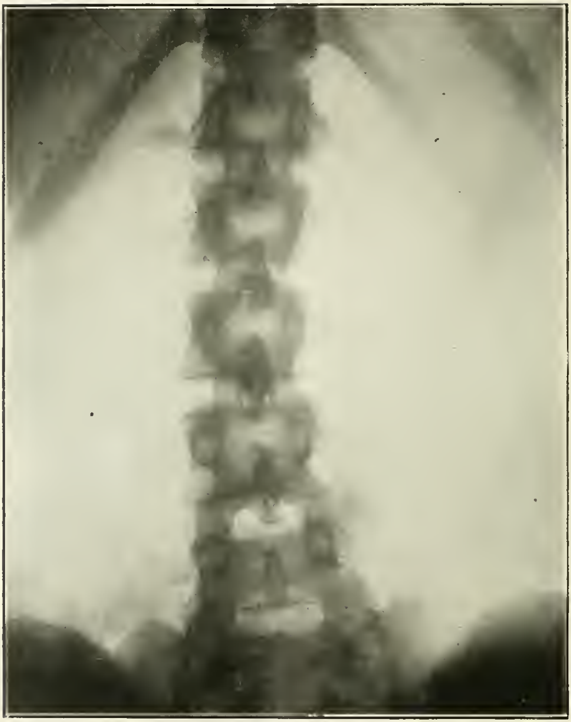

FIGURE 10

The shape of the vertebra in the above illustration is in keeping with that of the slender anatomic type and the sacrum is placed high which causes the apparent increase in the length of the lumbar spine. Upon the last dorsal vertebra upon the left side is an anomalous formation, apparently a rudimentary rib. This vertebra from the shape of the articular processes is evidently a dorsal vertebra and not a lumbar vertebra. The eleventh rib is long, slender at the neck and displaced downward as would be expected in the slender individual with the loosely attached viscera and the resulting low diaphragm. There are four unquestioned lumbar vertebrae with the partial lumbalization of the first sacral segment.

FIGURE 11

The illustration above shows a slender type of spine in the four upper lumbar vertebrae, but with the broad heavy type of vertebra for the fifth. The ribs in this case are of the slender type, with the exception of the last rib upon the right side which is much heavier in its general structure than the others.

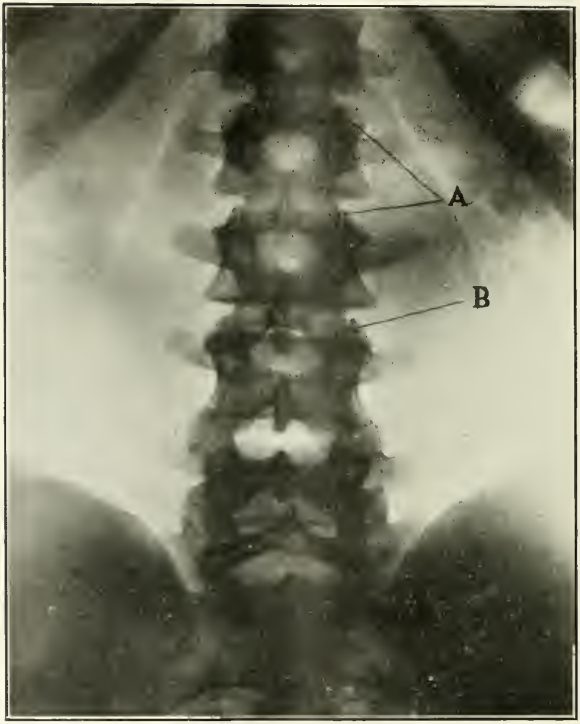

FIGURE 12

The above illustration shows the type of vertebra common to the heavy anatomic type, which are broad laterally but relatively thin in the horizontal axis of the body, with the distinct crescentic articulations, with the articulations, A. and B., arranged in vertical planes. The first segment of the sacrum as is shown by the laminae and the spinous process is partly formed as a lumbar vertebra. The ribs in this case are long and of the shape of the normal type. The downward displacement is that which would be expected in the slender type and would naturally be increased by the use of improperly fitted corsets.

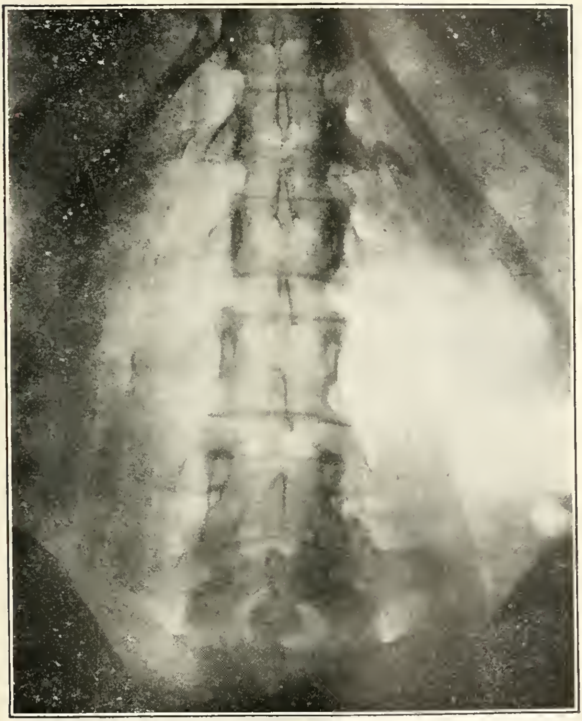

FIGURE 13

The width of the sacrum varies much with individuals, both male and female. The above figure shows a wide sacrum with a spine of the normal type leaning toward the slender with rudimentary last ribs. The possibility of the impinging of the 11th rib against the tip of the rudimentary 12th rib, with the pressure upon the intercostal nerve, must be obvious. Only four lumbar vertebrae are present in this case; the last dorsal vertebra or the vertebra having the rudimentary ribs attached, apparently having the characteristics of a dorsal vertebra.

FIGURE 11

The last lumbar in the above illustration shows a distinct lumbo-sacral transverse articulation upon the left side between the enlarged transverse process to the top of the sacrum. With the difference in the mobility of the two sides at this level, the rotation which begins at this level, in the above illustration, is fairly easy to understand. The imperfectly formed last rib upon the left side, and the short last rib upon the right, simply serves to emphasize the irregularities and the variations in the type of anatomy in this region.

understood, if the position which the long low ribs assume is considered in the relaxed posture so commonly seen in men and women, a part of which is the increase of the lumbar spinal curve with the backward inclination of the dorsal spine. In this position the ribs are in a plane well posterior to the transverse processes of the first lumbar vertebra and the catching of one upon the other becomes a question only of special shape or special move-

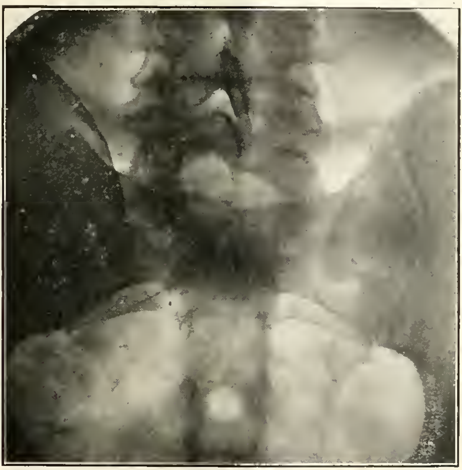

FIGURE 15

The spinous processes at times, as shown above, are large and heavy, and become twisted as the result of the over-riding in the relaxed postures, so common at the time of adolescence. The possibility of pain developing as the result of the actual contact between these processes as the result of the continued or increased relaxed habits of carriage, must be obvious.

ment. The relief of pain by raising the ribs, with the correction of the posture, or in the acute cases by bending the patient away from the side upon which the pain is, leads to little question as to the nature of the difficulty.

The study of the anatomic structure of this dorso-lumbar region shows that there is quite as much variation in the shape and position of the bones of this region as has come to be recognized

as existing in the low lumbar region. Since an exact knowledge of the structure of the individual seeking treatment is obviously essential if satisfactory results are to be obtained, this series of plates is presented.

In endeavoring to understand and to relieve the symptoms presented by a patient it must be remembered that every portion of the structure of this part of the skeleton varies at times. The shape of the body of vertebra varies, not only from the so called

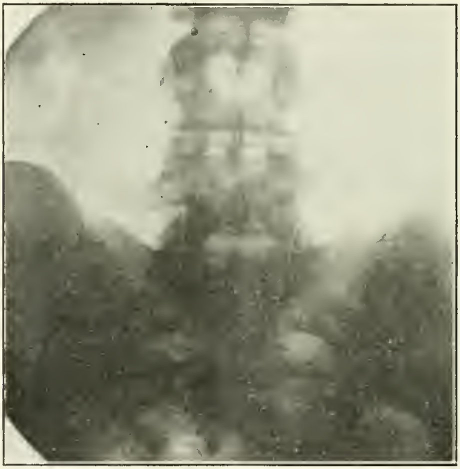

FIGURE 16

The articular processes of the lumbar spine, while according to the text books on anatomy are crescentic, at the same time are not always formed with the line of the articulation in the same plane on the two sides. In the left side of the above plate the line of the articulation is vertical, while on the right side it is distinctly oblique, leading to different degrees of motion on each side of this joint.

normal, but may show several different types in a single individual spine. The spinous processes vary in length, thickness and inclination, as is true of the transverse processes. The articular processes vary in shape, being flat, Fig. 17, with lateral plane or crescentic, Fig. 18, and in the latter the chief plane of the articular surface may be antero-posterior on a vertical plane—

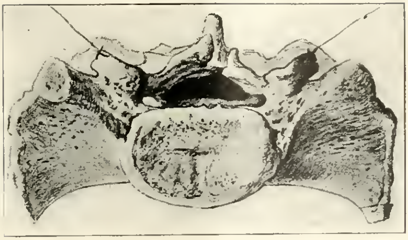

FIGURE 17

Top of sacrum showing the flat articular processes.

FIGURE 18

Top of sacrum showing the crescentic articulations into which the processes of the vertebra above are naturally locked.

FIGURE 19

Top of sacrum showing a flat articular process upon the left side, with a crescentic articular process upon the right side.

Figs. 2, 3, or 4, or oblique—Figs. 6 and 16. Such differences not only occur but differences may exist upon the two sides or at different levels in one individual. Fig. 19.

In interpreting the symptoms in a given case all of these things must be taken into account. The heavy spinous processes will naturally limit backward bending. The crescentic articulations will naturally limit side bending more than the flat articulation. The heavy transverse processes upon the last lumbar naturally come in contact with the sacrum more easily than the small so called normal process. The excessively broad transverse process with the articulation with the top of the sacrum, not only introduces another joint which may become diseased, but a joint which because of the unnatural mechanics involved, is particularly apt to be strained. The narrow lumbar vertebrae naturally tend to flexibility of spine; the broad and thin vertebrae naturally tend to stability and inflexibility of the spine. With a careful anatomic analysis of a case with the appreciation of the possible mechanics, most cases become understandable and relief fairly easy to secure.

I am indebted to Dr. Lawrie Morrison for the roentgenological study of these cases, the illustrations of which are used as the basis of the paper.

Announcement

NEWLY ELECTED OFFICERS OF THE AMERICAN ORTHOPEDIC ASSOCIATION 1920-1921

President—Robert B. Osgood, 372 Marlborough St., Boston, Mass.

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Treasurer—John L. Porter, 7 West Madison St., Chicago, Ill.

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Editor

H. Winnett Orr, 1010 Terminal Bldg., Lincoln, Nebraska.

Editorial

The July Journal has been slightly delayed awaiting discussions at the June meeting of important papers in this issue. In August and thereafter the Journal will be issued on time. Much valuable material is on hand for publication.

Among these are papers of importance by Dr. Lovett, Dr. Whitman, Dr. Steindler, Dr. Rogers, and others, read at the Toronto meeting. In addition a very valuable communication has just been received from Dr. Allison on the Orthopedic Surgery of the Forward area during the war. It is hoped that it may be arranged to publish later a comprehensive article on Orthopedic Surgery in the Base Hospitals in France, to follow the article by Dr. Allison.

The Journal of Orthopaedic Surgery—the real Journal of reconstructive surgery—has made its greatest progress during the past year. Incidentally, the subscription price of the Journal was increased at the Toronto meeting to $5.00 per year.

Meeting of London Fellowship of Medicine

The London Fellowship of Medicine and Post Graduate Association was formed in 1918. Sir William Osler was president at the time of his death. The object is to correlate and render more easily available the lectures and clinics in London. A weekly Bulletin is issued. The following is the program in Orthopaedics for the week of June 14:

Monday, June 14
- 9:00 Royal Nat. Orthopaedic H. .... Mr. Trethowan (Opns.)
- 1:30 Guy's Orthopaedic H. .... Mr. Trethowan (O. P.)
- 1:30 St. Bartholomew's Orthopaedic H. .... Mr. R. C. Elmslie (O. P.)

Tuesday, June 15.
- 1:30 St. Bartholomew's Orthopaedic H. .... Mr. Elmslie (Opns.)
- 2:00 St. Thomas's Orthopaedic H. .... Mr. Bristow (O. P.)

Wednesday, June 16.
- 1:30 Guy's Orthopaedic H. .... Mr. Trethowan (O. P.)

Thursday, June 17.
- 1:30 St. Bartholomew's Orthopaedic H. .... Mr. Elmslie (O. P.)
- 2:00 Roy. Nat. Orthopaedic H. .... Mr. Trethowan (O. P.)
- 3:00 St. Bartholomew's Orthopaedic H. .... Mr. Elmslie (Opns.)

Friday, June 18.
- 10:00 London Orthopaedic H. .... Mr. Openshaw
- 1:00 London Orthopaedic H. .... Mr. Openshaw (Lecture)
- 2:00 Westminster Orthopaedic H. .... Mr. E. Rock Carling

Orthopaedic Titles in Current Literature

Prepared by Dr. J. E. M. Thomson, Lincoln, Nebraska.

Andrews, E. W.—Two Cases of Myeloma. Surg. Clin., 1920, IV, p. 43.

Ansinn, K.—Wire Versus Nail Extension. Zentralblatt fur Chirurgie, March 13, 1920, 47, No. 11, p. 249.

Armstrong, Richard R.—Case of Cervical Caries Simulating Cerebellar Tumour. British Med. Journal, April 10, 1920, p. 499.

Babcock, W. Wayne.—The Immediate Sterilization and Closure of Chronic Infected Wounds; A New Method Applicable to Wounds of Bones and Soft Tissues. Am. Med. Ass'n. Journal May 8, 1920, Vol. 74, No. 19, p. 1301. (See abstract in this issue.)

Bahr, F.—Isolated Fracture of Coronoid Process of Ulna. Deutsche Zeitschrift fur Chirurgie, August, 1919, 151, No. 1-2, p. 100.

Barnard, F. S.—Bone Graft. Pacific Coast Journal Homeop., 1920, XXXI, p. 58.

Beck, C.—Ununited Fractures of the Tibia and Fibula, Repair by Open Operation and Wiring of Fragments. Surg. Clin., Chicago, 1920, IV, p. 115.

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Current Orthopaedic Literature

Application of Military Surgery to Civil Practice... C. Gordon Shaw, D. S. O., M. D., F. R. C. S. *Medical Journal of Australia,* January, 1920, Vol. 1, 3.

The recent war has left its effects on every department of national life. Reconstruction is the order of the day. It is inevitable that the principles and practice of surgery should be profoundly affected by the lessons taught and knowledge gained during the war.

Flesh Wounds—The principles involved in the treatment are given:

1. The wound should be thoroughly cleansed, devitalized, and damaged tissue excised. Blood clots are removed, as well as foreign bodies.

2. Measures are taken to sterilize the wound. Among the materials used are:

(a) Carrel Dakin solution.

(b) Fluorine.

(c) Salt pack.

(d) Spirits and "B. I. P. P."

The bismuth-iodoform paraffin paste is the author's preference.

3. Whether primary or secondary suture is performed depends on the case. Factors to be considered are:

(a) The length of time since receipt of injury. After eight hours, bacterial multiplication has begun to spread to surrounding tissues, making primary suture less likely to be successful.

(b) Contusion and devitalization of tissue predisposes to sepsis.

(c) Situation cf the wound. Parts with rich blood supply are less likely to develop sepsis.

(d) The obvious cleanliness of the wound. Infected material and dirt may be ground into the wound.

(e) Whether patient has lost considerable blood, as exsanguinated patients are more susceptible to infection.

Septic Wounds—Tetanus was practically wiped out by the use of prophylactic injection of anti-tetanus serum and the follow-up weekly injections. Gas gangrene was dealt with early by excision of all infected tissue, and washing out with peroxide solution. If the infection had progressed, amputation would have been necessary.

A polyvalent anti-gas gangrene serum was developed which would have answered a similar purpose as the anti-tetanus serum had not the armistice brought an end to this class of cases.

Often this organism existed in the wounds as a harmless saprophyte, giving no trouble for weeks or months after; when, after wound healing had taken place, symptoms flared up as the result of irritation, injury, or surgical interference. Among the activators of tetanus and gas gangrene are the toxins of the streptococcus, the appearance of calcium and rare earths.

For the prevention of the symptoms, then, (a) Secondary infection by streptococcus should be prevented. (b) Wound should be washed out to remove calcium salts. (c) Anti-streptococcus serum should be administered.

Latent Sepsis—Sepsis following secondary operations, even months after wound has healed, often chagrin the surgeon. They are due, by hypothesis, to organisms absorbed from the septic wound by the blood stream and deposited in other parts of the body, where they may remain latent until caused to flare up by some injury. The same cause may be the reason for stiff joints following wounds of the extremities.

If, before operation, the old wound is ionized with salicylic ions for from three to seven days, the scar is softened and sterilized so that the time elapsing between the healing of the wound and operation, say, for repair of nerves, was reduced to two weeks.

Wounds of Joints—The experience of the war has established the fact that the synovial membranes are very resistant to infection. The treatment may be considered under the following headings:

I. Bullet wounds of the joint, without injury to the bone. These should be let alone until or unless symptoms develop. Blood should be aspirated.

II. Lacerated wounds of the joint, without bone injury. Here the wound should be cleaned up, synovial membrane sutured, and entrance wound sutured or not, as the surgeon thinks fit.

III. Wounds of joints associated with bone injury depend upon the joint involved. In the case of the knee, ankle and shoulder, strength and stability of the articulation are of primary importance, while mobility is of secondary importance, while with the elbow and wrist, mobility is very essential. Every bone injury should be thoroughly exposed and completely cleaned, and dead or devitalized bone removed.

Where injury is slight, damaged portions of bone may be gouged out. If injury is severe, excision of the joint should be performed. Flail elbow from excision of this joint is not uncommon, and indeed difficult to treat. The author cleans each fragment of bone separately and places them in proper apposition with the hope cf obtaining union by first intention and ankylosis. When impossible to eliminate sepsis without the removal of so much bone that a flail joint must result, apparatus should be worn that will strengthen and stabilize joint, or bone grafting be done to establish false joint or ankylosis.

Septic Joints—The writer had the good fortune not to have many of these cases. Among the methods of treatment mentioned are (1) In early stages, aspiration; (2) A combination of aspiration and irrigation of the joint; (3) Drainage and "B. I. P. P." after arthrotomy. The Fullerton method consists of excision of joint and keeping the ends of the bones apart. The wound is left open for thorough irrigation and drainage.

Compound Fractures—These should be operated upon as early as possible. Among the favored procedures are:

First, the French method of removing all partly detached fragments of bone subperiosteally. In this manner the wound can be more thoroughly cleaned and

there is less risk of sepsis. Bone re-forms and the gap is filled. Careful splinting is essential.

The second method consists of carefully cleaning those fragments attached *in situ* and the removal of those detached, cleaning them with ether and replacing them in proper relation after wound has been cleaned.

Proper splinting is carried out. In this procedure the detached fragments form a scaffolding for the growth of new bone. However, these fragments predispose to infection.

Emphasis is laid on the replacement of wooden splints by metal standardized splints, which will mean a definite advance as applied in civil practice.—*J. E. M. Thomson.*

DISLOCATIONS OF THE DISTAL PHALANX OF THE THUMB. G. Maurice. *Revue d'Orthopedie* xxvii, 113-166.

Anatomy—The interphalangeal joint of the thumb consists in a convex surface at the distal end of the proximal phalanx and the concave surface of the end of the distal phalanx. The convex surface has a regular curve in the antero-posterior plane, is divided by a sulcus into two condyles, the whole widening out toward the palmar side of the thumb. The concave upper end of the distal phalanx is divided into two lateral glenoid cavities by a longitudinal ridge which fits into the sulcus in the opposite joint surface. The synovial sac is rather extensive and forms a cul-de-sac up over the anterior aspect of the condyles.

Physiology—The joint is, therefore, a trochlear one and permits practically only the movements of flexion and extension. Flexion is not limited by the dorsal ligaments nor even by the extensor tendon, for it is noted that the limit of flexion is the same whether the tendon is tense or relaxed. The real obstruction is at the anterior aspect of the joint where the edge of the distal phalanx impinges on the anterior face of the proximal phalanx and where the antero-lateral ligaments form a dense mass when compressed. Extension of the joint is also limited by the anterior ligaments rather than by the flexor tendon.

Etiology and mechanism—Statistics show that the distal phalanx of the thumb is dislocated much more frequently than that of the other four digits, the proportion being about 4 to 1; in fact, dislocation of any of the thumb joints is much more frequent than the same lesion in the finger joints. Posterior luxation is much more frequent than anterior. Of fifty-five cases reported by Polaillon only six were anterior. This, as well as the relative frequency of all dislocations of the thumb, is explained by the isolation and exposure of that digit and the usual direction of traumatizing force being backward. Probably the most common cause of backward dislocation is a fall with the thumb extended, which results in forced hyperextension of the distal phalanx. It is very difficult to produce this dislocation experimentally. Direct blows on the pulp of the thumb, the proximal phalanx supported on the edge of the table, are not effective. The only means of producing it is by forcible extension combined with a strong pressure upward in line with the axis of the thumb. The pressure upward is essential and if it is not exerted the distal phalanx may be hyperextended until

the dorsal surfaces of the two phalanges are in contact without a dislocation taking place. In the traumatic dislocations the downward thrust of the arm furnishes this longitudinal pressure.

Rupture of the glenoid ligament (anterior) is necessary to dislocation, at least in the living. As a matter of fact it is usually torn from its insertion, rather than ruptured. Integrity of the lateral ligaments is the rule according to most authors and experimental dislocation can be accomplished without rupturing them. Tearing of the flexor tendon is very rare in posterior dislocations, but it may be less rarely separated more or less from its insertion in the distal phalanx. The extensor tendon is never ruptured nor is the synovial sac on its dorsal wall.

The dislocation may be complicated by fracture either of the distal or of the proximal phalanx in some cases the fracture extending into the joint.

Two types of posterior luxation are described. The distal phalanx may be displaced at right angle to the proximal with the articular surfact of the former in contact with the dorsal side of the latter, the so-called primary type; or the long axes of the two phalanges may be parallel with only the anterior articular border of the distal against the dorsal surface of the proximal, the secondary type. The two types are so-called because it is held by some surgeons that the secondary is rarely the result of the original trauma but of attempts at reduction of the primary type. The author, however, holds that the secondary is the more common form of posterior luxation.

Obstacles to reduction—The most important of the conditions which prevent reduction is the interposition of fibrous or tendinous tissue between the joint surfaces, either the glenoid ligament, the flexor tendon, or both of these structures. Interposition of the capsule is impossible. Swelling of tendons, muscle, spasm, inflammation of soft parts, and the extreme brevity of the distal phalanx are not regarded as real obstacles to reduction.

Diagnosis is usually easy. The backward dislocation produces a deformity resembling the back of a fork. The axes of the two phalanges are in the same plane viewed from front or back, but from the side the axes may be either at an angle more or less obtuse or they may be parallel. If parallel there is overriding of the distal phalanz over the back of the proximal. Frequently, if not constantly, there is a transverse line of ecchymosis across the palmar surface of the joint. There is shortening of the entire thumb, there is no active motion, and attempts at passive motion cause much pain and very little movement.

The lesion is sometimes complicated by tear of the skin to such an extent that the head of proximal phalanx protrudes. This laceration is almost always transverse across the front of the joint. Another complication is ankylosis following irreducible cases, some of which come to amputation.

Treatment—Dislocations of not more than twenty-four hour's standing usually do not offer much difficulty to reduction. Later the inflammation and muscle spasm make the task harder. If the distal phalanx points backward at a right angle the method is simply to push it forward again. If the two phalanges are parallel the distal should first be bent backward, then pressure should be applied on its base from above down, and from behind forward. If reduction is difficult the thumb may be adducted over the palm thus relaxing the flexor

tendon which sometimes is an obstacle. Local anesthetic may be given if necessary around the base of the thumb rather than at the affected joint, to avoid further edema in the latter region. After the reduction it is well to fasten the thumb in a splint for some time to prevent recurrence.

According to Polaillon, about a fourth of the cases are irreducible. In these cases it is necessary to do an open operation. The best incision for this is a transverse semilunar one on the dorsal side, extending through about a third of the circumference of the thumb with its convexity downward so that the flap can be turned upward. On pulling the extensor tendon aside one can see the joint and determine the obstacle to reduction. If the flexor tendon and glenoid ligament are causing the trouble they may be pushed aside, if it is the lateral ligaments they may be cut. In some cases it may be necessary to do a resection in order to reduce the deformity. Compound dislocations must be well cleaned with iodin and the wound edges resected. Antitetanic serum should be given in all cases in which the patient sustained the injury in a fall alighting on the thumb.

Forward dislocations of the distal phalanx are much more rare than backward ones. They are usually the result of a fall in which the weight of the body came on the end of the extended thumb. This type of dislocation is peculiar to the thumb since it has not been observed in the fingers. It seems to be produced by a violent upward pressure when the thumb is in hyperextension. The lesion results in either of two types of deformity; the distal phalanx may be pointing backward over the end of the proximal, or it may be lying parallel with, and over riding the proximal phalanx in front. Diagnosis is easy; the only lesion with which the forward dislocation may be confused is a fracture at the base of the distal phalanx with forward displacement of the distal fragment.

Reduction of the angular type of deformity in anterior dislocations is easy, but more difficult in cases of over-riding of the phalanges. The mechanism is extension by traction on the distal phalanx accompanied by pressure from in front backward. Failure by this method is to be followed by open operation. Cases have been known to go unreduced and still have a fairly useful thumb.

Lateral dislocations are very rare, probably because of the great width of the bones as compared with their thickness. There is a displacement of the distal phalanx laterally and also an inclination of its long axis toward the same side.

Eight cases are reported, all posterior dislocations. Two of them were compound dislocations in one of which resection of the base of the distal phalanx was necessary. In another, an open operation was necessary to reduce the lesion.—*William Arthur Clark.*

A. Flockmann on the Krukenberg Hand. Betr. z. Klin. Chir. Vol. 117 No. 3. 1919.

Krukenberg's technic is described as follows: A U shape incision made over the stump from the volar to the dorsal surface, the incision being placed nearer the ulnar side. The muscles are then dissected. The flexor sublimis is split longitudinally, the flexor profundis and flexor pollicis longus are removed. The extensor muscles of the thumb are also removed. The pronator quadratus and interosseus ligaments are divided. The ulna and radius are shortened and smoothed off. A groove is then placed into end of radius and ulna running horizontally in radio-ulnar direction. The radial half of the flexor digitorum sublimis is sutured to the flexor carpi radialis; the ulnar half cf the fiexor digitorum sublimis is sutured to the flexor carpi ulnaris. The extensors are dealt with as follows: On the radius there remains the supinator longus and extensor carpi radialis. On the ulna remain the extensor carpi ulnaris and extensor digitorum communis. The radial group of flexors (adductors) is sutured to the radial group of extensors (abductors). The ulnar group of flexors (adductors) is sutured to the ulnar group of extensors (abductors) over the stump. Then follows the covering with skin of the radial half taking a volar flap for the covering on its interosseus surface. This leaves only the interosseus surface of the ulnar half without skin. This defect is taken care of by a pedunculated flap from the abductors.

Removal of 1 to 2 cm. of bone is advised. In suturing different muscle groups together it is arranged so that the flexor muscles are placed on the intersseus surface of extensors on the outer radial or ulnar surface.

The pseudoarthroses were later abandoned or at least reserved only for the ulna, in exceptional cases.

In regard to distribution cf muscles the original scheme of Krukenberg is as follows:

Abductor-flexors: biceps, pronator teres flexor carpi radalis and radial half of flexor digitorum sublimis.

Abductors extensors: supinator longus, extensor carpi radialis, longus and brevis; extensor digitorum communis.

Supination: supinator brevis.

Pronation: pronator teres.

The author's plan of muscle distribution is as follows:

Adductors: The ulnar 1/4 of flexors and extensors of fingers and flexor carpi ulnaris, also combined action of flexors and extensors.

Abductors: The radial 3/4 of flexors and extensors. Supinator longus, biceps, pronator teres.

Supinators: Supinator longus and extensors .

Pronation: Pronator teres and radial part of flexors.

The after treatment consisted of massage, galvanization and active motion.

The result in 4 out of 7 cases was ideal. The length of the stump was only 7 cm. The muscles were not divided too high up and the elbow was intact.

In conclusion the author points out that skin incision must be more on the ulnar side. In bone shortening over 2 1/2 cm. enough skin might be recovered by bayonet incision. Otherwise an abdominal flap must be made. The extirpa-

tion of muscle should be restricted as much as possible. If a pedunculated flap is used it should be severed on the 14th day. Long stumps are unfavorable. Nearthroses should not be made except possibly for the ulna in exceptional cases. —*A. Steindler, Iowa City, Iowa.*

RESULTS OF OPERATIONS ON PERIPHERAL NERVES. O. Stracker. Beitr. z. Klin. Chir. Vol. 17 No. 3.

Report on 369 cases, operation on 441 nerves.

Total resections 256, partial resections 46.

340 cases were re-examined sometime after operation. Of these 250 improved or 73½%. 48 cases cured or 14%.

Results cf different operative procedures. A Neurolysis: 118 cases. Re-examined 91 cases. Cured 21 cases or 31%.

Other operators report improved or cured after neurolysis 84% (Wesberg), 76% (Ranzi), 69% (Perthes).

B. Resections. Operations on 302 nerves of which 256 were total resections.

Sutures performed in total resections 178 cases. Re-examined 147 cases. Of the latter 111 or 75% were improved, with return of function in at least one muscle; cured 19 cases or 12% with return of function in all muscles. Of the 19 cases cured, 13 were suture of the musculo-spiral, 4 of the median, one of the ulnar and one of the brachial plexus.

The operative results of other observers show a much lower percentage in this group; Forster 86%, Ranzi 50 to 40%, Perthes 37%.

Of the 101 nerve sutures of the upper extremities all proximal muscles recovered 48 times. Of the 41 sutures of the lower extremities all proximal muscles recovered only 4 times. In the small muscles of the foot return of function could never be ascertained absolutely. This speaks for lesser regenerative power of the lower extremities, probably due to greater distance from trophic centers.

Time of Regeneration:

Musculo-spiral nerve: Supinator longus and extensor carpi radalis, 5 to 11 months. Extensor digitorum communis and extensor earpi ulnaris 8 to 11 months. Thenar muscles after 12th month.

Nervus Ulnaris: Flexor carpi ulnaris and flexor digitorum profundus 3rd to 11th month. Intrinsic muscles of the hand after the 13th month.

Nervus Medianus: Flexor carpi radalis, pronator teres, flexor sublimis digitorum, 1st to 10th month. Flexor Pollicis Longus after 6th month. Thenar muscles after 14th month.

Nervus Tibialis: Gastroenemius, tibialis posticus, flexor digitorum longus, 7th month. Other muscles after 10 months. Intrinsic muscles of the foot not recovered.

Nervus Peroneus: Peroneus longus, tibialis anticus, after 8th month. Extensor digitorum longus after 10th month. Extensor hallucis after 16th month.

All these dates indicate the beginning rather than completion of regeneration

Suture in partial resection 46 cases. Re-examined 35 cases. Of these 29 cases or 83% showed return of function at least of one muscle.

Relation of resection to time elapsed at operation (suture).

One to three months: Distinct improvement 66%, slight improvement 14% (21 cases).

4 to 6 months: Distinct improvement 50%, slight improvement 32% (46 cases).

7 to 22nd month: Distinct improvement 24%, slight improvement 50% (69 cases).

C. Bridging. Edinger method, i. e. use of serum agar tubes, applied in 27 cases of which 22 were re-examined. Only one case showed improvement; Foramitti's method, the use of hard veins for insheathing the nerves, was applied in 32 cases of which 17 were re-examined. Of these 17 cases 9 gave positive results, or 60%. The bridge amounted from 3 mm. to 12 cm. Distinct results however were only obtained in a gap less than 3 cm.

D. Transplantation. Transplantation was carried out in 11 cases. The transplanted gap amounted to 5½ to 8 cm. No results were obtained.

E. Splicing of Nerves. 4 cases. Method consisted in implantation of normal nerve laterally into the paralyzed one. 2 cases are reported having given results. In one case a branch of the median nerve was implanted into the musculo-spiral nerve. Active extension of the wrist was obtained after 18 mo. In another case there was an implantation of the 7th root into the 6th root with regeneration of the intrinsic hand muscles after 25 months.

F. Direct Neurotization. All attempts at direct neurotization gave no results. Dynamometric measurements of the muscle energy of recovered muscles show that even in favorable cases the power regained was not more than 1/12 to 1/3 of the normal.

Sensory disturbances in successful operation are usually improved but not entirely relieved. The temperature sense was rarely re-established. Trophic destructions are improved. Ulcerations are more frequent of the foot than the hand. In 3 cases of sciatic nerve paralysis trophic changes of the bone and sequestration of the metatarsals was absolute.—*A. Steindler, Iowa City, Iowa.*

THE IMMEDIATE STERILIZATION AND CLOSURE OF CHRONIC INFECTED WOUNDS. By W. Wayne Babcock, M. D., Philadelphia. *Jour. A. M. A.*, Vol. 74, No. 19, 6-8-20.

With the mass of the chronic infections of war, the aim of the Carrel-Dakin treatment—the early closure of the wound—has not been attained.

A treatment successful in the hands of highly skilled enthusiasts may fail in routine use when it exacts infinite care as to detail over prolonged periods of time, and when it is adapted only to selected cases and requires repeated operations and multiple dressings at times most painful.

We have sought an agent for chronic pyogenic infections that would do rapidly, under adverse conditions and in one operation, what the Carrel-Dakin treatment does so slowly under the most favorable circumstances, and with two or more operations.

A number of chronic ulcers, some previously treated by skin grafting, and several infected hernia wounds, healed primarily after sterilization, incision and suture. The bone infection cases were unselected, had a variety of infecting micro-organisms and included the worst cases at Fort McPherson. In but one case was the bacterial count below infinity. All had from one to nine sinuses, and had had from two to eight previous operations. Some had multiple sequestra, complete fracture, associated abscesses, and joint or periosteal complications. The duration of the disease had been from seven months to more than a year, part of which time there had been weeks and months of Dakin treatment. A few lacked skin preparation when brought to the operating room, and had purulent crusts and pustules.

The osteomyelitis most frequently involved the tibia and femur, but the pelvis, humerus, fibula, radius, tarsus and metatarsus, ribs, clavicle, scapula, and mandible were also treated. In two pelvic cases the peritoneum was opened, while the hip joint and the knee joint were each invaded five times from a previously purulent field.

With bone infections, devitalized and insufficient soft tissue, multiple and closely adjacent scars, complicated sinuses and hematomas have presented difficulties not found in the usual operation. The operative results could not be judged as after the usual aseptic operation. Tightly sutured wound edges not infrequently showed a limited necrosis. Accumulated secretions from the enormous wound surface often escaped thru the stitch holes or between the sutures. Stitch abscesses and spreading phlegmons were rare and usually all openings were closed and the wound healed at the end of six weeks. Of the first 100 cases only four have required reoperation, none of the older healed cases have relapsed, and present evidence is that a good technician should be able to overcome from 70 to 95% of his chronic bone infections by a single operation, percentage varying with the location, extent of the lesion, amount of viable soft tissue, and thoroughness of the operation.

In 350 cases, there was one death attributable to the operation. This occurred before the danger of injecting zinc chloride without a tourniquet was appreciated.

Technic.—The method consists of four procedures carried out in one operation under anesthesia:

1. Chemical sterilization of all sinuses and wound surfaces by the injection and application of a saturated solution of zinc chlorid.

2. Delineation of infected areas by the injection or application of an alkaline ethereal solution of methylene blue.

3. Mass excision of the entire area of infection.

4. Wound closure with the obliteration of all dead spaces.

Skin Preparation.—The wound area should be prepared by daily shaving, washing with soap and water, removal of all scabs and crusts, and the application of a 2% mercuric oxid in zinc ointment for three days preceding the operation.

Wound sterilization:—On the operating table, under local or general anesthesia, the skin is (a) thoroughly scrubbed with "B" solution, (b) painted with 3% solution of tincture of iodin, and (c) sterilized by a saturated solution zinc chloride which is thoroughly injected under pressure or packed with small moistened pledgets into all sinuses and cavities, applied to all unhealed and granulated surfaces, and rubbed very carefully over the scar and skin adjacent to the wound. Five minutes are allowed for the penetration of the zinc solution, great care being taken that every recess of wound is reached. If injected under pressure, the general circulation must always be protected by a tourniquet. The injection will not be made into fistulas connecting with the bladder, intestine or any other important viscus, nor will this method be used in the presence of erysipelas or other acute spreading infection or before the normal tissue barriers to sepsis have been erected.

Color Delineation.—The antiseptic staining solution is then applied to all eroded surfaces and injected under pressure or packed with cotton pledgets into cavities and sinuses. As soon as this solution has evaporated, the exposed granulating surfaces are left dark blue-black, dry, bloodless on manipulation, and sterile. If a section is made thru the sinus, it will be found that the coloring has penetrated to a depth of from 1 to 3 mm. Outside this is a much wider zone of avascular grayish white tissue that has been sterilized and devitalized by the zinc chloride. Some of the sequestra removed after the treatment from deep bone cavities have produced no growth on culture mediums.

ANTISEPTIC STAINING SOLUTION

Saturated alcoholic solution of methylene blue	20 Gm. or C.c
Caustic Potash	3
Phenol	5
Ether	to make 100

Excision of Infected Area.—The field is again painted with tincture of iodine, and a very free skin incision made, so planned as to permit later closure and to surround and to be well outside of all scars and sinuses, which are to be excised as nearly as possible en bloc. The instruments are now changed, the skin margins well separated from the adherent underlying tissues by traction with sharp retractors, and dry towel or gauze clipped in position to isolate the wound. The incision is now deepened to the bone, the periosteum is freely incised and retracted from entire circumference of bone, protected by towels or gauze, and, beginning some distance from the diseased area, with sharp chisels, the infected bone is freely excised with the attached underlying skin, scars and sinuses. Care is taken not to divide the bone completely, but the healthy medullary cavity should be freely exposed. A blue color indicates that all infected areas have not been removed and that the incision is to be continued. The operator should use very sharp knives, gouges and chisels, and work centripetally from outside the septic focus, rather than with curets, which tempt one to work from within out. All soft tissues and bone should be removed to a distance of at least 1 cm. beyond the bone coloration.

Scars.—As a rule, the scar is excised.

Large Bone Defects.—These, especially if near the articular ends, may be filled with pediculated flaps of muscle or other soft tissue, or lined by large

pediculated thick skin flaps. The inward transposition of the head of the tibialis anticus and extensor longus hallucis is useful for filling large defects of the head of the tibia. The defects left by removing skin flaps may be closed by plastic operation or skin grafting. If there is a complete fracture, the bone ends should be beveled to chisel edges and appropriate extension and immobilization should be maintained in the after-treatment.

Multiple Sinuses.—These should be excised. If left, the entire sinus tract will usually later be expelled in the form of a tube of necrotic tissue. To avoid secondary hemorrhage, no zinc infiltrated tract should be left adjacent to a large blood vessel.

Secondary Hematomas.—Bleeding from bone may be controlled by gauze pressure or by pressing bits of muscle into the bone. Bleeding from soft tissues should be carefully corrected by forcipressure, fine catgut ligatures, or sutures. A lateral stab or incision thru an adjacent scar may be left for drainage.

Wound Closure.—Muscles and soft tissues are sufficiently liberated from the skin and bone and each other to fit into the bone defects. If possible, the bone should be covered with a layer of muscle and aponeurosis as well as skin. Muscles should be well freed and sutured with the edges inverted and rolled in so as to fill all bone cavities or depressions. Plain catgut sutures are used to unite the deep tissue layers, and the skin is closed with an inverting mattress suture of silkworm gut. Only a dry technic is employed. A sterile 10% solution of sodium bicarbonate is kept at hand to neutralize the zinc chloride in case of accident.

After-Treatment.—The early dressings should be copious and should give supporting pressure. Wet, nonirritating, antiseptic dressings are applied for the first week and until all tissue reaction has subsided. For this purpose Solution "C" is used which is injected into the gauze dressings thru incorporated rubber tubes every two to four hours. The part is well supported and is kept quiet, elevated and warm.

SOLUTION "C"

Chloral Hydrate	1 Gm or C.c
Alcohol	10
Glycerin	25
Saturated Solution of boric acid	65

The adjacent skin is to be kept clean and coated with 2% yellow mercuric oxide ointment.

Unless the surgeon can prevent the entrance of the zinc chloride into the general circulation during and for five minutes after the injection, and unless he is able to excise freely all chlorided tissue adjacent to the important structures, he should not employ the method.—*Leo. C. Donnelly, Detroit.*

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INJURIES TO THE SESAMOID BONES OF THE GREAT TOE

BY ALBERT H. FREIBERG, M. D. F. A. C. S., CINCINNATI, O.

Read at the Annual Meeting of the American Orthopedic Association, at Toronto, June, 1920

Since 1904, when Stieda (Beitr. z Klin. Chir. XLII, 1) published his article on this subject, quite a number of articles have appeared in which there has been discussed the significance of symptoms assigned to the region of the metatarso-phalangeal joint of the great toe on its inferior aspect. In these cases, the x-ray showed for the most part that the mesial or tibial sesamoid bone was divided by a transverse cleft, into two parts; now nearly of equal size, now of quite unequal proportions. On the other hand, other observations have been made corroborating those of Stieda to the effect that both of the sesamoid bones of the great toe are sometimes divided congenitally and that in this event we are likely to find the sesamoids of the other foot similarly divided. Most of the reports which are to be found in this connection are in substantial agreement in the character of the symptoms, but there is considerable variance in the writers' views as to their meaning. The absence of all reference to this subject in the various treatises and text books which I have consulted is so uniform that one is inclined to believe their authors in agreement with the ancient mystics who believed, according to Hyrtl (Lehrb. d. Anat. 20th Ed. 1889, p. 438) that the mesial sesamoid of the great toe was the one unbreakable, incombustible and indestructible bone of the body which remains in the earth after death as the germ from which the whole body is to be resurrected on the Day of Judgment. I have not endeavored to ascertain whether it is incombustible, but I am convinced that it is not unbreakable. Geist (Am. Journ. Orth. Surg. 1915) having examined 100 clinically normal feet, found congenital division present in 16. Since this

seemed to me an unusually large proportion, I requested Dr. Karl Little to examine a large number of x-ray plates of feet in the collection of the Cincinnati General Hospital, with this object in view. Over 1000 plates were examined in consecutive order and without reference to the reason for making them. To my surprise, he found only one plate in which a transverse division of the sesamoid was present; this concerned the mesial sesamoid only and the other foot was not examined. (Fig. 1.)

FIG. 1.

Gen. Hosp. Obs. A. 84—Man admitted for contusion of left foot and leg. Run over by coal wagon. Dismissed the same day. Sesamoid condition not noted at the time.

FIG. 2.

Gen. Hosp. B. 4401.—Man admitted as result of automobile accident. Wheel passed over foot. X-ray showed comminuted fracture of *lateral* (fibular) sesamoid of great toe. Dismissed five days later and not again heard from.

My interest having been aroused by two cases in which the inferior aspect of the first metatarsophalangeal joint was the seat of pain, in which the x-ray showed division of the mesial sesamoid and in which the nature of the condition had not been recognized by well trained surgeons, I have investigated my private case records with respect to injuries of this bone. As a result I conclude that the sesamoid bones of the great toe are not rarely the seat of traumatic damage and that they are subject to all of

the varieties of trauma which are common to their better known congener, the patella; moreover, that in a general sense the mechanism of their production is the same.

I have met with one case of luxation of the mesial sesamoid. The patient was a man of 50 who struck his toe against a chair when moving about his bedroom in the dark. There was marked local swelling and the sesamoid could be plainly felt on the inferior and mesial aspect of the joint. The patient brought an x-ray with him from another city; where the accident occurred. Unfortunately he was permitted to take it away and I am unable to produce it. The bone was removed under local anesthesia and the diagnosis confirmed.

I have seen several instances in which the line of fracture was of such character and direction that its traumatic nature would be universally acknowledged. In two instances there was comminution and in all of this group of cases, the history points to direct violence as the cause. This is analogous to the fractures of the patella where we find that the stellate, comminuted or oblique fractures are those which are produced either by direct violence or by comparatively slight direct violence against the patella with the quadriceps in strong contraction. (Fig. 2.)

These cases are however, not the ones to which the greatest interest attaches, but rather those in which the x-ray plate shows the division to be more or less transverse and, more especially in which the patient is unable to furnish a definite history of violence from without, nor for the most part, of sudden onset. I was led to make an investigation of the histories and x-rays found among my private cases chiefly through the experience which I had with an infantry officer during the war and just prior to my entering upon active military service. This man was 40 years old, a lawyer by profession, and had entered the service voluntarily. While still in training camp and after a long spell of duty in the training trench, he complained of pain on the inferior and mesial aspect of the right great toe joint. This not only produced a limp but interfered with walking so that he was compelled to report to the medical officer. No definite diagnosis was made; complete rest was ordered and in a few days he was believed to have recovered completely. The swelling and tenderness which had been present had entirely disappeared. Duty was resumed and

the pain and swelling promptly recurred. This cycle was gone through several times with the same result, without a definite diagnosis being made and with the final insinuation of exaggeration of symptoms, to say the least. When I was now consulted, I found distinct swelling on the mesial and inferior aspect of the first metatarsophalangeal joint with great tenderness on pressure over the mesial sesamoid. The other metatarsophalangeal joints were not tender. X-rays of both feet were made; on the right side the mesial sesamoid was found divided by a cleft slightly oblique. A small third fragment was seen on the outer side and apparently joined to the distal fragment by a slender bony pedicle; there appeared to be some evidence of new bone formation going on between the two large segments. In the left foot, the mesial sesamoid is of dumb-bell shape giving the impression either of having been divided and later united or, of having a thin place where fracture might conceivably take place with ease. I ordered mechanical protection, as later to be described, but am not informed as to the later course of this case. (Fig.3.)

FIG 3.

No. 1653.—Infantry captain, 40 years old. No history of definite injury. Oblique division of mesial sesamoid. A third small fragment seen to outer side and connected to distal fragment by a pedicle. The mesial sesamoid of the symptomless foot is dumb bell shaped.

Aside from two cases in which the mesial sesamoid was fractured by direct violence and to which no special interest attaches in the present discussion, I have been able to find fourteen cases in my private records in which I feel that the symptoms which brought the patients to me were localized in the mesial sesamoid of the great toe and were to be ascribed to the division of this bone which was demonstrated by the x-ray. For the most part,

FIG. 4.

No. 4780.—Girl 20 years old. Seven years before felt sudden pain in ball of right great toe, while running. Felt like stone bruise, but has never entirely recovered. Plantar surface of joint is swollen, somewhat red and tender. This X-ray made one year after above note made; no further symptoms. Right mesial sesamoid shows healed fracture; left mesial sesamoid is dumbbell shaped.

there was no history of injury by violence and in no instance did the patient find it necessary to seek relief immediately after the injury. In nearly all there has been the experience of recurring cycles of pain in standing and walking, with some swelling of the great toe joint, subsiding after restricting activity and reappearing after it had been resumed for a time. The tenderness has been quite characteristic in its location over the mesial sesamoid. The X ray has been relied upon for the definite diagnosis and has

shown a cleft dividing the bone into a distal and proximal fragment, usually of unequal size.

Cases of this kind have been reported by various observers in no very small number but there is difference of opinion as to the significance of what has been seen in the x-ray plate and chiefly for the reason that it seems beyond question that division of the sesamoids occurs not infrequently as a congenital anomaly and without producing symptoms. I have observed one instance (No. 5498) in which there were no symptoms attributable to the sesa-

Fig. 5.

No. 4764. Girl 17 years old. Got splinter in plantar surface of left great toe joint seven months before. Since then repeated attacks of pain and tenderness. Marked swelling and tenderness over mesial sesamoid. X-ray looks as if there had been fracture of sesamoid with subsequent union.

moids at all and in which the x-ray showed the mesial sesamoid of the left foot divided into two fragments and that of the right into four. On the other hand, in at least fourteen instances symptoms were to be ascribed so definitely to the region of the mesial sesamoid bone and in the most of them mechanical protection to this region resulted so promptly in relief, that the discussion of the precise pathological meaning of the x-ray appearances might seem purely academic. In view of the fact, however, that in sev-

eral instances the x ray gives evidence of the possibility of healing by bony union and because in the absence of local protection the symptoms have sometimes recurred repeatedly a different attitude of mind would seem justifiable. Stumme, (Fortschr. a, d. Geb. d. Roentgenstr. 1909, Vol. 13, p. 312) believed that he determined that true fracture existed in one case by the excision and careful examination of the fragments. He felt also that he had proved by experiment upon the cadaver that forcible dorsiflexion of the great toe with abduction could produce fracture of the mesial sesamoid. He believed also that it was possible to distinguish between traumatic division and congenital cleavage by the x ray appearance. The fracture shows sharp and pointed corners, whereas congenital cleavage is apt to show rounded ends; the ends of the fracture line show a break in the cortical substance and this

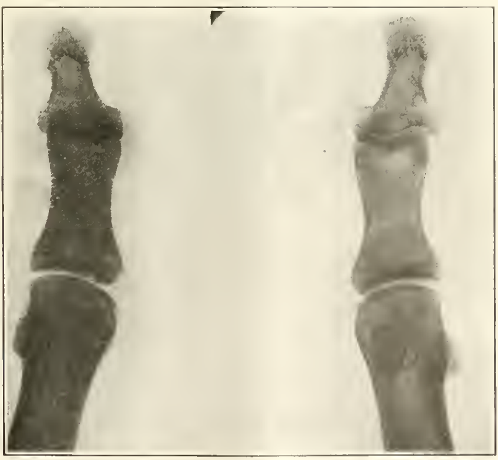

Fig. 6.

No. 5846.—Man 32 years old. Repeated attacks of pain and swelling in great toe of right foot. Very tender over mesial sesamoid and evident swelling. Stepped on round stone nearly two years ago and thinks trouble dates from this. Right mesial sesamoid shows transverse division into almost equal parts. On plate cleft is seen to be distinctly jagged. Relieved at once by mechanical treatment. Left foot normal.

is continued around in congenital cleavage; the fragments of the traumatic variety are of irregular shape whereas the congenital ones are prevailingly oval and finally the evidences of reparative activity are presumptive evidence of fracture. In a case reported by T. R. G. Orr (Annals of Surg. 1918, LXVII, p. 609) there was a history of two distinct injuries to the bone and a later x-ray

FIG. 7.

No. 3743.—Woman 33 years old. Pain on inner side of plantar surface of left great toe joint for about ten weeks. No recollection of injury. Pain was continuous at first but now dependent upon use. Mesial sesamoid shows oblique irregular line of division with appearance of repair. Lateral sesamoid shows a central thin spot. No record of right foot.

showed bony union to have taken place. I believe, therefore, that sufficient evidence exists to warrant the belief that some of these cases represent true fracture and that bony union may take place. It should therefore be striven for. In at least two of my cases, division of the mesial sesamoid in the symptomless foot and the character of the cleavage make it seem probable that I was dealing with a congenital anomaly; at the same time, the distinct localization of the pain and tenderness make it altogether likely that the cleft was the seat of traumatic damage and the treatment was effective in producing permanent relief.

In one instance, that of a girl of twelve years, I was consulted because of recurrent pain and tenderness which I ascribed to the region of the right mesial sesamoid; (No. 5858) the x ray showed that both sesamoids of this foot and the mesial sesamoid of the left foot were divided. I should say that these clefts corresponded to the congenital variety, if Stumme's distinctions are to be admitted; not only because of the fact that three of the four sesamoids are involved but also because the corners are somewhat rounded and the corticalis seems continuous around the whole periphery of each segment. In this case relief was at once afforded by the application of a felt pad immediately behind the tender spot; this was continued for a number of weeks until the local tenderness was quite gone. In this patient the longitudinal arches of the feet are very high and she is being given exercises

Fig. 8.

No. 4113.—Woman 26 years old. Direct injury to right foot two weeks before. Great tenderness over lateral sesamoid which was not suspected as seat of injury before X-ray was made. This shows longitudinal fracture of lateral sesamoid but also division transversely of mesial, apparently of congenital character. No X-ray of left foot made.

to strengthen the toe flexors. Thus far there has been no recurrence of pain although the case is still under observation.

The fact that there is a congenital division of the sesamoid instead of a traumatic one in no wise alters my feeling as to the mechanism by which the production of the symptom is to be explained. In the act of rising on the toes and with a degree of abduction of the great toe, the sesamoids and more especially the mesial, act as a fulcrum upon which the weight falls. According

Fig. 9.

No. 4609.—Man 22 years old. Came because he had been called in the draft, for service. No history of injury, but for the past six months has been having attacks of swelling pain and tenderness in right great toe joint after athletic exercise. Marked tenderness over mesial sesamoid and some swelling. X-ray shows divided mesial; cleft oblique and somewhat irregular. Left foot on separate plate, is normal. Pronounced unfit for immediate service. Further course unknown.

Fig. 10.

No. 3705.—Woman 31 years old. Injury to foot six months before. Recurring attacks of pain and swelling in right great toe joint. Movement in flexion is accompanied by distinct grating. Tenderness over mesial sesamoid. X-ray shows almost transverse cleft in proximal third of mesial, with jagged edges. No record of other foot.

to the extent to which the power of the long flexor has become weakened, as by the effect of shoe wearing, the stress upon the sesamoids in the short flexor becomes greater in this position. The sesamoid may thus become the seat of a cross breaking strain which may cause it to part into two divisions; or, in the event of a congenital cleft may result in damage to the fibres which connect the two segments. I should therefore regard the symptoms as of traumatic origin in this case also.

FIG. 11.

No. 5858.—Girl aged 11 years. No history of injury. Pain and tenderness over mesial sesamoid of right foot. No swelling. Both feet weak and pronated. X-ray shows both sesamoids of right foot divided; apparently congenital type. Left mesial sesamoid also divided. Relieved by mechanical protection.

In three of the cases observed there has been an appearance in the sesamoid as of new bone formation and some progress toward union of the fragments; in two cases, the mesial sesamoid of the symptomless foot has a dumbell shape, suggesting either that a fracture had healed or that the bone was congenitally thin at this point. In neither case was the patient able to remember having had symptoms which would furnish an explanation.

In none of my cases, save the one of luxation, was there operative intervention. The treatment consisted of the application of a thick pad of felt immediately posterior to the point of tenderness and its retention by means of adhesive plaster. This pad was replaced every few days until the tenderness was gone; an anterior heel or cleat of leather, $\frac{1}{4}$ to $\frac{3}{8}$ inch thick and $1\frac{1}{4}$ to $1\frac{1}{2}$ inch wide, was then inserted between the layers of the sole of the shoe just behind the metatarsophalangeal joints. At this time exercises were instituted for developing the flexor power of the toes.

Fig. 12.

No. 5498.—Girl 13 years old. Comes because of pain in region of anterior arch of left foot. Third metatarsophalangeal joint of left foot is tender and quite thickened. X-ray made for this reason. No symptoms attributable to sesamoids of either foot. Mesial of left foot divided transversely; that of right foot divided apparently into four parts. Lateral sesamoid of right foot shows nick at mesial border; shows in less degree on left foot also.

In none of my cases did I fail in this manner to bring about relief of the symptoms promptly. In the greater number of the cases I am able to speak of the relief as having endured. In several, however, the patients have passed from observation and they

have not been followed up. I feel however, that in the event of recurrence of symptoms I should have become informed of this.

I feel as if an apology were due for presenting a paper upon a subject so unimportant. At the same time, I also feel that by recognizing the meaning of these conditions I have been able to treat these patients more rationally. In one instance I have been able to save a man from no little humiliation and in a number of instances have been able to put an end to the cause of repeated interferences with physical activity and even vocational disability.

Discussion

Dr. Twinch: I should like to ask the reader of the paper if he has seen enlarged sesamoids in these cases? Some two or three years ago an article in *Surgery, Gynocology and Obstetrics*, the author expressed his opinion that hallux valgus was caused by enlarged sesamoids and that the cure was the removal of these bones. Since reading the article referred to I have removed the sesamoids when operating for hallus valgus, and finished the operation by simply removing the hypertrophied bone on the inner side of the head of the metacarpals.

Dr. Sayre: One man that I saw had pain on flexing his toe. The sesamoid appeared normal but the proximal phalanx was dropped so low that on dorsiflexing his toe it struck the metatarsal head. I removed the superior surface of the metatarsal head, allowing the toe to slide up and so relieved the symptoms.

Dr. Freiberg (closing): It is often hard to determine whether or not there has been fracture or whether the condition is congenital, but I think there is often trauma, even in the congenital cases.

Dr. Hammond (closing): In reply to Dr. Twinch, the sesamoid does not seem to be enlarged. The patients had conservative treatment without relief and this led me to remove the sesamoid. I think Dr. Freiberg is right as to trauma being a cause of the condition because both the sesamoid and the metatarsal show erosion spots from pressure.

THE JONES OPERATION FOR THE ANKYLOSIS OF SUBDELTOID BURSITIS

BY WALLACE BLANCHARD, M. D., F. A. C. S., CHICAGO

Read at the Annual Meeting of the American Orthopedic Association, at Toronto, June, 1920

Subdeltoid bursitis is one of the most common and at the same time the most frequently unrecognized of the shoulder injuries.

During the first month it is often difficult to make a diagnosis of bruising of the subdeltoid bursa and supraspinatus tendon and the patient frequently passes out of the hands of the attending surgeon before calcareous degeneration and shoulder joint fixation develop.

The following case has a typical history: A factory man, aged 42 years, had a slight fall and caught his weight on his hand. The pain that followed was severe, but the arm could be moved in all directions. The factory surgeons reported that no fracture or anything abnormal could be found by physical examination or seen in the radiogram.

They put the arm in fixation dressings for a month and when it was set free the patient still complained of severe pain and inability to use the arm. Thereupon the industrial insurance company declared the man to be a malingerer and no longer entitled to indemnity. For several months he remained in disgrace and without his rightful compensation.

When he came into my hands, firm adhesions had formed in the shoulder joint and there was strong resistance to motion beyond an arc of 15 degrees. The man was hard to handle because he was a giant in size and strength. Under an anaesthetic and following the method of General Sir Robert Jones the patient was held upon his back so that the scapula rested securely upon the table. The assistant's fist was placed in the axilla and against the head of the humerus to prevent a possible downward dislocation. The arm was moved firmly into abduction and rotated inward and outward and then pushed backward to its normal limit. Then finally the arm was given forcibly its full radius of movement. The breaking of the adhesions in the

shoulder joint sounded like the fracturing of bones. Two days later the man could reach as high above his head with one hand as with the other and declared himself cured. Jones warns against half-hearted attempts to break up the adhesions and also against the danger of increasing the amount of cicatricial tissue by injudicious passive movement early in the disease.

Fig. 1. Radiogram showing a lime salt deposit about the size of a split pea at the apex of the head of the humerus.

I have broken up the adhesions of subdeltoid bursitis upon the operating table without an anaesthetic in a number of cases. These patients had fixations ranging in duration from two months to two years but always got perfect and almost instantaneous relief.

This forceful method should not be used except when the painful fixation is caused by a sterile deposit of lime salts and after a careful examination has been made to exclude active dis-

ease and the other forms of painful disability of the arm. Brickner[1] has emphasized the sterility of the lime salts deposits with 200 cases of open operation for the relief of ankylosis of subdeltoid bursitis without finding a trace of infection of any kind.

The radiogram here presented, Fig. 1, shows a lime salt deposit about the size of a split pea on the apex of the head of the humerus.

In this case the patient sustained an injury of the shoulder that produced a fracture of the clavicle. The fracture united firmly with some displacement, and when the fixation dressings were removed a painful ankylosis of the shoulder joint remained which mystified the attending surgeon. Two months later the lime salt adhesion in the shoulder joint was broken up by the Jones method with instant relief of the painful fixation. The force required to break the adhesion in this case was greater than seemed warranted by the small extent of the lime salt deposit seen in the radiogram. The lime salt deposit was in an early formative stage and if the breaking up had been delayed a year, the deposit would have shown three or four times larger and several shades darker in the radiogram.

It is frequently noticed in ankylosis of the shoulder joint that the rather free mobility of the scapula imparts considerable movement to the arm even though the fixation of the head of the humerus may be quite complete. Bucholz[2] has reported a fracture of the humerus made in an attempt to forcibly break up the adhesions in a case of subdeltoid bursitis. It is conceivable that lime salts may accumulate around the head of the humerus till the adhesions may become stronger than the bones contributing to the shoulder joint, so that the humerus may fracture under force without the giving way of the articular adhesions. I never expect to see such a case, and if it does appear the radiogram will surely give a timely warning. It is safe to say that the Jones method of breaking up the adhesions in the fixed and painful shoulder of subdeltoid bursitis will be found to be uniformly successful in properly selected cases.

In cases which I believed would yield to moderate force, I have simplified the operation by dispensing with the assistant's

1. Brickner: Journal A. M. A., 1917, Vol. 59.
2. C. Herman Bucholz: Orth. Sec., A. M. A. Trans., 1917.

fist in the axilla and moving the arm forcibly backward to its normal limit and then swinging it around in its full radius of movement with the same satisfactory results. In occasionally using this shorter process I have followed a precedent established by the originator of the operation.

Nine years ago I saw Sir Robert Jones stand a British officer against a door frame and break up subdeltoid bursal adhesions that had existed for several years. The painful ankylosis was immediately relieved and the patient was cured so quickly that it seemed as if I had just witnessed a good turn of legerdemain.

DISCUSSION.

DR. TRUSLOW: I am interested in the question of lime deposits. I had a case in the winter, a young woman, on whom I operated and thought I had removed the deposit, but the X-ray showed about one-third left under the acromium process. The other side has become painful and the X-ray shows the same trouble there.

DR. OSGOOD: I remember one case of lime salt deposit in an elderly gentleman. I did not feel inclined to give him an anesthetic and made a rather gloomy prognosis. Two months later the X-ray showed not a single trace of the deposit. The symptoms disappeared without any operation.

DR. RUGH: I have had a similar experience to that of Dr. Osgood, but I used hot fomentations, twice a day, followed by massage, and the X ray showed disappearance of the exudate.

DR. FREIBERG: I don't think you can place reliance on that. I have seen a disappearance of these deposits without any fomentations at all, or any other form of treatment.

DR. SAYRE: It is quite possible that the lime salt deposit is there and you don't see it the first time. I have seen it appear within half an hour. It happened to be behind the head of the humerus and so was obscured by the shadow, and became visible when another X-ray was taken with the humerus rotated outward.

DR. BLANCHARD (closing): The supraspinatus tendon is always involved in the lime salt deposit of subdeltoid bursitis. Dr. M. S. Henderson has reported the case of a farmer with subdeltoid ankylosis who fell from a ladder catching himself so that his body weight broke the shoulder joint adhesions and effected an immediate cure.

OSTEOMYELITIS

BY DR. F. C. KIDNER

In civil practice, bone infection is usually of hematogenous origin, altho direct infection thru a wound of the soft parts, does occur. In military practice, bone infection of hematogenous origin does occur, but most of the cases are due to infection thru the skin. Blood infections invade and spread in bone, thru well-recognized anatomic channels, the blood vessels. Infection thru the skin is in no way dependent on anatomy. The two forms of osteomyelitis, are therefore, essentially different, at least till the very late stages.

Acute osteomyelitis of blood origin, will affect the area of bone supplied by the whole arterial system, as in the fulminating, destructive type in childhood, or it will affect larger or smaller areas of medulla and cortex, in accordance with the size of the arterial branch, by which the infectious material enters. Thus we may have an acute osteomyelitis, involving a whole bone shaft, or merely a localized infected area, as in the Brodie's abscess. Only secondarily, does hematogenous osteomyelitis spread by direct extension, to surrounding areas of bone. It is therefore, fairly safe to predict, after the determination of the first area of infection, what the ultimate limits will be.

In infections occurring from without, the anatomy of the blood vessels is of little importance. The spread of the infection depends on the areas of bone immediately soiled, on the extent of the fissures and cracks formed, and on the devitalization of medulla and cortex, thru the destruction of blood supply.

In both types of bone infection, the amount of damage depends on the relation between the virulence of the infecting organism, and the inherent resistance of bone to infection. This resistance is greater when the blood supply is good, and less when it is interefered with. Therefore, comparatively non-virulent organisms may cause wide-spread and persistent infection when the blood supply is wholly or largely destroyed, while virulent organisms may cause only sharply limited and mild infections, if the blood supply is good. Thus, a simple staphylococcus may bring about the destruction of the whole shaft of a tibia when it enters thru, and blocks the arterial supply of the bone. On the other hand,

a virulent streptococcus, even with a gas bacillus may cause only a localized process, if it enters from without, and does not interfere greatly with blood supply.

Bone infection spreads rapidly and widely thru the blood stream. It spreads slowly or not at all, by extension and contact if drainage can be established. If drainage is inefficient, there comes into play, the factor of pressure or tension. If pus is under tension in any part of bone, there is a pressure necrosis of the adjacent tissues, which break down in spite of nature's attempts at walling-off. This breaking down constantly exposes new tissue to re-infection and the spread of the disease is rapid. This is not true where proper drainage exists. Early, thorough drainage of all acute bone infections is, therefore absolutely essential.

It was the recognition of this fact that led to and established the popularity of the Carrel-Dakin method, and later, debridement, in war surgery. Wide exposure of infected bone, as advocated by Carrel, was basically correct, but the pendulum swung too far. It was forgotten that even soiled bone, if it has a blood supply, maintains power of resistance to the spread of infection. Therefore, the advocates of bone debridement agreed that all soiled bone must be removed. The result was often pitiable. Three or more inches of soiled bone was removed from a shaft and prompt healing was often obtained, but at a tremendous price as regards resulting function. Wide opening of soft parts down to, and around, infected and damaged bone, was necessary but removal of all such bone was unwise. Many surgeons adopted the proper mid-course and preserved all fragments which had any semblance of attachment to soft parts, and then left the wounds wide open. In their cases, it made little difference whether drainage was kept up by Carrel-Dakin tubes and solution, or by any other means, which prevented blocking back, of the discharge. The results were uniformly the best possible for the case at hand. It was often startling to see fragments of bone, which at the first operation had appeared to be almost certainly dead, re-acquire a nutritive blood supply and take up the formation of new bone, even tho they lost a part of their substance by ultimate sequestration. These war lessons should then, give us much help in the treatment of bone infection, in civil life.

In hematogenous infections, drainage should be immediate and open up the whole area of the infected blood supply. X-ray,

as Hammond says, will not show the limits of the infected area. Direct observation, thru a cortical incision, made sufficiently large, is the only method of determining the extent of the disease. In the compound fractures of civil life, thorough opening of the whole field damaged by the trauma, with wide drainage, is the only safe procedure if virulent infection is suspected. Secondary closure of compound fractures, which prove themselves to be sterile, is a simple matter. Infection of bone, appearing after a wound is closed, is apt to be a serious matter.

Theoretically, acute osteomyelitis should never develop into chronic. If drainage could be made sufficiently thorough and sufficiently early, there would be no opportunity for bone necrosis and spread of the infection. Unfortunately, however, in hematogenous infections, these two desiderata are rarely obtainable. We can only hope to approach them more and more closely by earlier diagnosis; as Simmons has insisted, and by more thorough operation at the hands of more skilful men. In the compound infected fracture, occurring in civil life, the lessons of the war should teach us that there is very little excuse for the establishment of chronic osteomyelitis. Civil conditions, except under unusual circumstances, allow early complete operation, and operation in competent hands should establish efficient drainage and get ahead of the infection, as skilful thorough operation does, in sepsis of the hand, foot or other soft part. I am convinced that the principles of skilful and conservative debridement, should be applied to all compound fractures. Not the mass debridement which was so popular among many army surgeons and so destructive of function, but the careful, accurate surgical removal of devitalized soft tissue from every nook and cranny of the wound thru an incision large enough to allow inspection of every crevice, accompanied by removal of fragments of bone which are soiled and totally detached from soft parts. All attached fragments should be cleansed and replaced, as nearly as possible, in their normal position. All periosteum should be carefully preserved, because, in spite of all discussion, it does regenerate bone, and has a very active power of resistance to the destructive effects of infection. After such a complete operation, if there is any possibility that septic material has been left behind, the wound should be left wide open and drained in any efficient manner, such as Carrel-Dakin, rubber tissue, or other method, which allows flushing of all parts of the wound. It is far

better to leave such a wound wide open for a few days till culture proves it to be aseptic, than to close it and have sepsis develop later. Following such a preventive operation, the mechanical treatment of the fracture is of greatest importance. Absolute rest in good alignment, is a sine qua non. Such treatment will invariably lead to prompt closure of the wound and prevent osteomyelitis. In a recent case, a farmer was seen nine hours after a fall from a tree into richly fertilized garden soil. He had sustained a compound, comminuted fracture of the upper end of the ulna, internal condyle of the humerus, and a dislocation of the head of the radius. The local doctor had merely washed the fragments and replaced them. Immediate operation was done thru a wide incision, which excised the edges of the skin-wound, and with the aid of repeatedly changed knife and forceps, the torn, damaged and soiled, soft parts were all dissected away. There were no free fragments but many loose ones. These were cleaned mechanically with rongeurs, scissors and knife. The wound was left partly open over its deepest parts, and the fracture immobilized in a position which direct inspection proved to be good. There was secondary healing in ten days, no resulting bone infection, and an elbow function of 80% of normal, in spite of the fact that the patient was fifty-seven years of age, and that culture from operation showed streptococci.

When chronic osteomyelitis is established, the problems of treatment become most complicated. Extension of the process from the original focus has occurred, either by gradually extending necrosis and re-infection, or thru the vascular medulla. How far this extension has gone, is, I believe, beyond our present methods of examination to determine. The X-ray shows only sclerosis or actual destruction. It does not show any new areas, which are more or less actively infected. The extent of periosteal thickening is not co-incident with the extent of the infection; that is, deep infection may extend far beyond the periosteal re-action. The X-ray does not always distinguish between sequestra and vital fragments. It is extremely difficult to tell what the virulence of the infecting organism may be. Operation, under such conditions, must be a more or less blind procedure, as well as a dangerous one. Mechanically, it is very hard to reach and remove all infected areas, or it may, as so often happened in our war cases, lead to an intense virulent general flare-up, which endangers the patient's life. These facts are undoubtedly true of the average chronic osteomyelitis,

during the early stages; that is, during its first eighteen months. Virulent infection may lie dormant in bone for very long periods, in civil practice, as in war cases. A recent case will illustrate this: A child, who had had a septic, compound fracture of the humerus, was operated on, for non-union eighteen months after all wounds had healed. The ends of the sclerosed bones were simply split and interlocked; no metal nor other foreign body being left in. Six hours after the operation, the child had a temperature of 105. Next day the site of operation was tensely swollen, the child was delirious and the temperature was 106. The wound was opened wide and cultures from the ends of the bones showed a streptococcus.

What then, are we to do with established osteomyelitis? Two methods of procedure were advocated overseas, and are still advocated in the army services. The first is radical operation, with the removal of all infected bone as soon as acute symptoms have subsided, followed by sterilization of the wide-open cavity by one of the methods of irrigation. The second is the more conservative procedure of watchful waiting over long periods of time, supplemented by the occasional incision of abscesses, with the gentle removal of frank sequestra.

Theoretically, the first method, carried out at the earliest possible date, is the ideal one. In many cases, at the hands of the most experienced and skilful surgeons it has been successful, and has been followed by complete, and probably permanent healing. In the hands of the average man, I am convinced it has done much harm, because of its inherent difficulties. Practically, it is not always possible to distinguish and remove all infected bone, in widespread, active osteomyelitis, without, at the same time, sacrificing much good bone and infecting areas previously unaffected. The technique too, of maintaining sterility after the radical operation is very difficult. In an experience of two years, first with the British, and later in American army hospitals, I have become persuaded that conservatism is the wise course in the vast majority of routine cases. Most cases of infected fractures will, under proper splinting and rest reduce themselves to a low-grade localized osteomyelitis with firm union. Such cases ultimately reach a stage where function is possible, in spite of one or more easily cared-for sinuses. To be sure, flare-ups frequently occur, but these can al-

most always be controlled by a few days' rest with the application of heat, or by the simple opening of an abscess.

Careful observation of parallel cases, treated by the two methods, first at the Military Orthopedic Hospital in London, and later at the U. S. A. G. H. No. 36, at Detroit, have not shown any marked superiority of results, in the cases treated by the radical method, at the end of one to two years. Most of the radically operated cases, have recurred and the patients have had to be subjected to multiple operations, as in the conservative method.

It was my practice at General Hospital No. 36, during the spring and summer when I was in charge of the orthopaedic service, to treat osteomyelitis by the most rigidly conservative methods, allowing radical operation only when the enthusiasm of my co-workers became uncontrollable. The result was that when the patients were transferred to another hospital in July, there was very little disabling or generally harmful osteomyelitis among them. Since then, it has been my good fortune to see many of these cases when on leave in Detroit. All of them have had from one to five operations for the cure of their osteomyelitis, done, so far as I can gather, on the radical plan. All of them have been made more or less sick and been confined to bed for prolonged periods. None of them is any better than he was eight or ten months ago under conservatism.

So strong a plea for conservatism sounds pretty hopeless, and would not be worth making, if there were nothing to offer as a way out. This, I believe, there is, and it lies in the one word, patience. The vast majority of chronic osteomyelitis will, given time, become quiescent and sharply localized. That is, the infecting organism will become practically non-pathogenic and the infected focus will become thoroughly walled-off and delimited. It will reach a stage where infected can be recognized in contrast to healthy bone, by the X-ray. How long this will take, no man can tell, nor will external physical signs determine. The only test is exploratory operation. By this is meant an operation which enters and explores the infected bone, but makes no attempt at radical removal. If such an operation is followed by no re-action, then we may be reasonably sure that attempts at radical removal may be safely made, with only the mechanical difficulties to cope with, and with prospect of permanent cure. The type of operation must

depend on the size, shape and position of the infected area. In the shafts of the long bones, if any healthy bone is left in the thickness of the shaft, the lateral method of excision, advocated by Chutro, is the best, as it provides better muscle and soft part masses to fill the gap. Removal of the whole shaft, for the length of the infected area, is sometimes necessary. If the periosteum is preserved, this can be done, with the hope of regeneration even in adults, and it at least offers opportunity for later grafting.

To sum up then: the treatment of osteomyelitis is, in fractures where infection may enter thru the skin, prevention by thorough, immediate cleansing, and drainage; second, conservatism of the most thorough sort, for very long periods; third, radical operation of the most careful and thorough sort, when infection is completely quiescent and the extent of the diseased bone can be predicted.

I regret that I have had no opportunity to use the method of Wayne Babcock published in the J. A. M. A. May 8, 1920. His radical operation under zinc chloride sterilization and staining of the infected tissues, sounds very attractive, but very difficult.

NERVE LESIONS FOLLOWING COMMON TYPES OF BACK STRAIN AND THEIR RELATION TO PROGNOSIS OF DISABILITY.

DR. HAROLD W. WRIGHT, SAN FRANCISCO

Read before the San Francisco Neurological Society, June 4, 1920.

The forms of back strain which are illustrated by the following case reports are such as are frequently met with in industrial and private practice. Their exact pathology is often very obscure. In consequence of this obscurity faulty diagnosis and prognosis is apt to be made.

Many of these cases are satisfactorily dealt with by prompt reference to an orthopedic surgeon but many are disabled for a much longer time than the orthopedist expects them to be. In such, a careful neurological examination will frequently shed more light on the cause of prolonged disability and thereby serve to contribute to a more accurate prognosis.

The cases reported in this paper are illustrations particularly of low back strains due to lifting heavy objects while the spine is strongly flexed and strains due to sudden falls or mis-steps while the patient is off guard and which result in symptoms and signs referable to the various branches of the lumbar-sacral plexus. One case is an exception in that the effects of the trauma were at a higher level. (See Case III.)

Owing to the many structures which can be involved in a sudden strain of the back the pathology may be multiple in its manifestations and such complications as arthritis may still further confuse the clinical picture.

The main purpose of this paper is to demonstrate that common types of back strain frequently result in something more complex and more disabling than a simple strain of the sacro-iliac or lumbar-sacral joint.

Case Reports.

Case I.—A young laboring man in July, 1919, while lifting some heavy sacks from the ground strained the lower back. An X-ray examination showed an impingement of the transverse process of the fifth lumbar vertebra upon the iliac crest on the right

side. He complained greatly of pain in the distribution of the sciatic, obturator and genito-crural nerves of the right side. A plaster jacket was applied with the spine in the hyper-extended position but this gave no relief and the transverse process was removed in March, 1920. The pain in the obturator and crural regions had gradually subsided but the sciatic pain has persisted and he has developed symptoms of irritation of the superior gluteal nerve and the external cutaneous nerves of the right thigh which have persisted for several months. Examination shows hyperesthesia in the distribution of the superior gluteal nerve and external cutaneous nerve and the pain in the sciatic nerve has been so severe so to require alcohol injection. After a year from the date of the original injury he is incapacitated for any work.

Case 2.—A professional golf player of thirty years fell down a ladder and struck the right buttock. This occurred on November 18, 1918. He has since complained of pain in the distribution of the superior gluteal nerve, especially when standing or bending forward. Massage, manipulation and a low back brace have failed to relieve him. The X-ray showed no pathology. An examination of his spine shows on May 1, 1920, a diminished lumbar curve with rigidity of the lumbar muscles when the spine is flexed forward or laterally.

The tonsils are infected. The pain in the superior gluteal nerve continues and after eighteen months he is incapacitated for work. In this case an arthritis in conjunction with a slight plexus lesion must be considered.

Case 3.—A man now forty years of age wrenched his back while climbing a telephone pole in October, 1913. Immediately after he had symptoms of obstruction of the bowels and a laparotomy was done. The cause of the obstruction cannot be learned. He recovered and enlisted in the navy and after the war was discharged in good condition. In May, 1919, while lifting a piece of timber he again strained his back and experienced severe pain in the lumbar region with numbness of the legs, frequent urination and obstinate constipation. A neurological examination seven months later showed weakness and loss of tone in the muscles of both legs and thighs, exaggerated tendon reflexes, double ankle clonus and Babinski and a gait which was a combination of ataxia and spasticity. Sensation was diminished in the lower extremities but particularly on the left side. He was not seen again but

recently it has been learned that he was operated on for a suspected cord tumor and the report of the surgeon is as follows: "Extensive thickening of the dura from the level of the 4th to the 6th dorsal vertebrae and extending around and along the nerve roots. Pathological diagnosis is 'pachymeningitis chronic.'" There was no laboratory evidence of syphilis in this case. This patient evidently had extensive extra-medullary and intra-medullary hemorrhage following a comparatively slight form of trauma, (back strain), without any bony lesion of spine and the exudate had become firmly organized.

Case 4—A man of thirty-two on December 1, 1916, fell down an incline while running and struck the right side of his back. He continued to work for a month. Then one morning just after getting out of bed he noticed a severe pain in the right leg along the entire distribution of the sciatic and was unable to walk. An examination three months later showed diminished sensibility to light touch along the anterior crural nerve of the left side with hyperesthesia to painful stimuli, patellar reflexes equal but exaggerated, Achilles reflex very active on the left but absent on the right. The X-ray showed some time before this a fracture of the transverse process of the right fifth lumbar and he had been in a plaster jacket for several months. A month later the neurological examination revealed the same signs as before and two years after the accident he was still complaining of pain in the right sciatic nerve. He is at work but has continued to require a pelvic belt.

Case 5.—A young carpenter on February 19, 1917, was pinned under a heavy piece of timber and in trying to extricate himself he twisted his body violently. Immediately he suffered severe pain in the right inferior gluteal nerve and later in the right sciatic nerve. X-ray showed fracture of the transverse process of the right fifth lumbar. He was put in a plaster jacket and his pain was entirely relieved. A week after the accident the neurological examination was negative. Two months later he was complaining of pain in the right sacro-iliac region and downward across the right buttock and a neurological examination showed a definite loss of tone with some atrophy in the gluteus maximus and weakness of the tensor fasciae femoris; Achilles reflexes absent on both sides, plantar reflexes very active. The fractured transverse process was then removed. A few weeks later he was doing light work but continued to have pain in the back and right leg. This case was then put

up to the State Commission and it was considered that some of the man's pain was due to scar tissue in the soft parts and some of it to a neurosis. A year ago, over two years after the accident, he was still doing only half time work. Whether a neurotic element entered in to this case or not it is apparent from the above findings that the man sustained a severe plexus injury with interruption of the fibres going to the inferior gluteal nerve and either an intra-neural or extra-neural lesion of the sciatic.

Case 6.—A man of thirty years slipped on a wet floor and fell backward striking the left side of his body. He got to his feet readily and went to work. About two weeks later he began to have dull pain down the back of his left leg from the hip to the ankle. Adhesive strapping, hot baths, massage, etc., failed to relieve him. A neurological examination showed acute pain in the left sacro-iliac on pressure over it with cold sensation in the left leg; partial loss of sensation in the distribution of the small sciatic, gluteal, anterior crural and obturator branches of the plexus; Achilles reflex absent on the left. X-ray showed cloudiness of left sacro-iliac joint. Wasserman test positive. The man recovered entirely without any special treatment in about a year.

Case 7.—In March, 1917, this man, while lifting about two hundred pounds from the ground had a sudden pain in the middle of sacral region and was unable to move his legs. Later the pain radiated down the right leg posteriorly to the knee. X-ray showed congenital defect in the fusion of the spinous processes of the sacrum, a fracture of the sacrum through its middle portion at the level of the third spinous process and a twisting of sacrum between the ilia. Symptoms were partly relieved by manipulation and a plaster jacket. Neurological examination showed hyperesthesia on the back of the left heel with a more active Achilles reflex and patellar reflex on the left side. There were no objective signs in the right leg although this was the side on which the patient complained of pain. A month later the same signs were present. The patient has since been lost track of. It is interesting to note that the objective signs were on the opposite side from the subjective symptoms.

Case 8.—A deck hand of fifty-five years strained his back and right hip while wheeling a barrow load of sugar on February 6, 1917. X-ray showed congenital failure of union of the spinous processes of the sacrum and an impingement of the transverse process

of the right fifth lumbar upon the ilium. Neurological examination a month later showed a marked degree of hyperesthesia to all stimuli in the distribution of the right sciatic and gluteal nerves; Achilles reflex absent on both sides, patellar and other reflexes normal. His symptoms were relieved by a plaster jacket but two months later he began to complain of pain in the right sacro-iliac joint radiating upward to the angle of the right scapula with hyperesthesia to light stimuli in this area. The former neurological signs were still present. Three months later the patient was at work.

Case 9.—An athletic carpenter of forty-five years while lifting a heavy object from the ground in August, 1919, strained the back and abdominal muscles so badly that he went to bed for two weeks. Then tried to work but had to give up after two days. X-ray and spinal puncture were negative. A sacro-iliac belt worn high relieved him somewhat. Examination of the teeth showed one abscess. The heart was found deficient in its myocardium and there was a mild degree of secondary anaemia. Examination of the spine six months after the injury showed only a slight flattening of the normal lumbar lordosis with limited motion of the 7th and 8th dorsal vertebrae. When the patient did no work of any kind he was free from symptoms but as soon as he attempted even light work he would experience pain in the lower dorsal region and would become very fatigued and nervous, perspire freely and then be afraid to attempt work again. He was sent to the writer as a case of traumatic neurosis. Under psycho-therapy and treatment of his anaemia he showed much improvement in general health as well as in self confidence but on going back to light work he again had a recurrence of distressing pain in the lower dorsal spine. Later in the course of treatment and examination by the faradic current it was noticed that the muscles at the left of the dorso-lumbar spine did not respond as well as those on the right side and that those of the right side were in a state of spasm when the patient was in the upright posture. The same was true of the response to the galvanic current. The complaint of pain after effort was always located at the same point, about the level of the seventh dorsal. The patient appeared sincere, eager to return to work and his compensation was not sufficient to keep him out of debt, but in view of past experience of recurrence of symptoms he was afraid to attempt his regular occupation. Neurological examination negative in all other. In this case we are probably dealing

with strained soft parts, e. g., ligaments and possibly partially torn muscle and nerve fibres in a small area of the dorsal region, causing a weakness of the paraspinal muscles at this level. Until conditions are normal in these parts the patient cannot be expected to take up arduous work and in the face of the physical signs he should not be classified as a neurotic.

Comment.

In commenting on the cases reported the writer wishes to call attention to the signs that were present in all except the second case of actual lesion of one or more branches of the lumbar-sacral plexus. The form of lesion cannot be demonstrated or proved but that either an intra-neural or extra-neural lesion was present is shown by such signs as persistent pain in spite of immobilization of the spine, sensory losses or disturbances, loss of muscle tone, isolated muscle weakness and absent Achilles reflexes. In the third patient there were signs of involvement of the spinal cord and this was proved by operation and pathological section to be the result of extensive subdural hemorrhage, also extra-dural.

Attention is called to the chronicity of symptoms in the majority of these patients and the long period of incapacity for work. In seven cases the average period of industrial disability was fourteen months; in two of these seven the period was two years, in one case twelve months, in another twenty months, in one six months and in another three months. One patient is permanently disabled.

News Notes

The address of the chairman, Dr. Roland Hammond, before the Orthopedic Section at New Orleans, appears in the July 24 number of the Journal A. M. A. Dr. Hammond's title was "The Relation of Orthopedic to Industrial Surgery."

Ex-King Manuel has been elected an honorary member of the British Orthopaedic Association. King Manuel was largely influential in the establishment and maintenance of the curative workshops in the Orthopaedic Centers during the war.

The Cameron prize of the University of Edinburgh has been awarded to Sir Robert Jones in recognition of the highly important advances he has made in Orthopaedics and his many valuable contributions to the literature of the subject during the past five years. One of the conditions attached to the prize is that the recipient shall give a lecture or course of lectures in the university. The prize was founded in 1878 by the late Dr. A. R. Cameron, of Richmond, New South Wales. It is of the value of about 150 pounds, and may be awarded annually to a person who within the previous five years, has made important and valuable additions to practical therapeutics. The first recipient was Pasteur, the second Lister. The prize has not been awarded since 1915, when it was given to the late Sir Lauder Brunton.—*British Medical Journal.*

The Board of Governors of the American Hospital in London entertained Dr. Charles H. Mayo at dinner on July 6. The Earl of Reading, Sir W. Arbuthnot Lane, Mr. A. J. Balfour, Mr. Davis and Dr. Mayo were the speakers.

MEDICAL AND SURGICAL HISTORY OF THE WORLD WAR

Among the important work under way in the office of the Surgeon-General of the Army is the preparation of the medical-surgical history of the World War. Col. Charles Lynch, M. C., is in charge of this work, and is assisted by Colonels Brooks, Siler, Moncrief, Wolf, Oliver and Major Kramer of the Surgeon-General's staff.

The history will include an account of the work done during the war in a great many branches of modern scientific medicine and surgery. Subjects to be presented and medical officers who will present such subjects are set out in the following:

Administration, Western Front, Lieut-Col. Louis C. Duncan.
Administration, United States, Lieut-Col. Fielding H. Garrison.
Narratives, Col. Bailey K. Ashford.
Sanitation, Col. W. P. Chamberlain.
Sanitation, Western Front, Col. Haven Emerson.
Internal Medicine, Gen. W. S. Thayer.
Surgery, Gen. John M. T. Finney.
Neurology, Col. Thomas W. Salmon.
Oto-Rhinology, Lieut-Col. Joseph R. McKimon.
Statistics, Maj. Albert G. Love.
Pathology, Col. William H. Welch.
Hospitals, Lieut Col. Casey A. Wood.
Communicable Diseases, Col. Hans Zinsser.
Gunshot Wounds, Col. George E. Brewer.
Aviation, Col. Thomas R. Boggs.
Gas Defense, Col. H. L. Gilchrist.
Reconstruction, Col. Frank Billings.
Ophthalmology, Col. George E. deSchweinitz.

It is expected that the history will contain about fifteen volumes, and according to present tentative plans the respective volumes will cover the following titles:

I. Introduction.
II. Administration—United States.
III. Administration—Western Front.
IV. Statistics. Mathematician Interpretation of Data (Anthropometry).
V. Sanitation in the United States, Including Possessions.
VI. Camps and Cantonments.
VII. Hospitals.
VIII. General Medicine.
IX. Neurology.
X. Surgery.
XI. Gunshot Wounds.
XII. Pathology.
XIII. Physical Reconstruction.
XIV. Air Service.
XV. Chemical Warfare.

—*Jour. A. M. A., July 24.*

Orthopaedic Titles in Current Literature

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Current Orthopaedic Literature

Conservative Treatment of Sarcoma of the Long Bones. Estor and Aimes. *Revue d'Orthopedie*, May, 1920, 193.

The question of amputation or disarticulation in cases of sarcoma of the long bones has usually not been open to discussion. Recently, however, due to the fact that many patients refuse radical treatment, surgeons have turned to more conservative intervention. In view of the good results which often followed such conservative treatment the discussion was opened by Gangolphe, Jaboulay, and Mickulicz in a series of publications, regarding the wisdom of amputation in all cases.

The evolution of the conservative treatment may be divided into three periods.

In the first period, about 1870-1880, the choice was between amputation and disarticulation, no other treatment was considered. Disarticulation seemed to be generally preferred to amputation.

In the second period, under the influence of Nelaton who insisted on the benign character of some of these growths, resection of the tumor was done in some selected cases by Verneuil, Terrier, and Schwartz. This procedure was opposed by Ollier, who condemned resection on the ground that the limb was usually useless afterward, and maintained that the surgeon who removed the most tissue was ultimately the most conservative. In 1882 Heurtaux resected the upper third of the humerus for what he believed to be tuberculosis. The lesions proved to be a round-cell sarcoma but the patient recovered without recurrence. This was the first instance of resection of a malignant tumor of long bone.

Third period. Gangolphe did his first case of deliberate resection for a presumably malignant sarcoma of a long bone in March, 1902, and has advocated the same procedure in cases where the tumor is well encapsulated.

It is due to the Lyonnaise school, with Gangolphe, Jaboulay, Polloson, Bevard, Cavaillon, and Alamartine, that surgeons have turned more to the conservative treatment.

The essential points in the teaching of this school are:

1. Histologic examination does not always fix with certainty the degree of malignancy of a sarcoma. Certain forms which are considered histologically as benign are capable of evolving into marked malignancy. Quite frequently a benign tumor contains a mixture of cells some of which are of malignant type and the exploratory osteotomy does not happen to strike any of these malignant cells. It may be said then that bone tumors are not benign or malignant according to their histologic nature, but they are potentially benign or malignant. The error of the surgeon has been, up to the present, a desire to establish a correlation between the histologic nature and the clinical evolution of osteosarcomata.

2. Macroscopic examination shows that a sarcoma is generally circumscribed and does not infiltrate into the surrounding tissue as a carcinoma does. In the encapsuled sarcoma there is a partial enucleation particularly if it develops in a region rich in connective tissue. Even if there be no capsule the borders of the sarcoma are distinct and always recognizable. In the medullary cavity if examination is made 5 or 6 cm. from the macroscopic limit of the tumor it is exceptional to find neoplastic elements. The epiphyseal cartilage line acts as an efficient barrier to the growth of an osteosarcoma.

3. Many patients are frightened away by the proposal of radical amputation in the early stages of bone tumors and do not return to the surgeon until too late. On the other hand if a conservative operation is suggested in the same early stage the patient will usually submit.

4. The functional result obtained by saving a hand in cases of sarcoma of the humerus is of utmost importance. After resection, the arm may be supported by a prosthetic apparatus and the hand retained in all its usefulness.

5. Resection of malignant tumors from other parts of the body is done continually and there is no reason why the results from resection in the limbs should be any worse than those from the same procedure in the various organs of the body. Statistics compiled by Gross in Philadelphia show that bone tumors invade the soft parts in only 12 to 66 per cent of the cases, depending on the type and that sarcomatous adenopathies occur in only 7.6 to 8.33 per cent. Moreover, the adenopathies are in many cases purely inflammatory and disappear after the tumor has been removed.

6. Statistics concerning local recurrence and metastases following disarticulation or amputation are not brilliant. Of seven cases followed by Koenig after disarticulation, one died two days later, one after a year, four died from metastases in one to three years, one case followed only six months. Borck followed thirty-six; twenty-two died the first year, two the second, one the fourth, and one the fifth year; of the remaining ten, six died of other disease and only four survive. Ten other series are given in the text of the article, all showing similar figures.

As to the results of conservative operation Kocher in 1906 reported fifty-three cases of various forms of osteosarcoma that had survived three years or more. Of these twenty-two had had resection and thirty-one amputation or disarticulation. Chirpaz studied twenty-seven cases which had survived from eight to ten years, all of which were either resections or enucleations.

The authors give in this paper their results in 138 cases: Humerus thirty, radius twenty-two, ulna twelve, femur thirty-six, tibia twenty-seven, fibula eleven, all of which were treated by conservative operation. The majority of these sarcomata were of the giant cell type, many of the spindle cell and round cell type, and most all other types were represented by one or more cases. Two were removed by simple excision, twenty-nine by currettage and 107 by resection.

Cases suitable for simple excision are very rare. One of the two was a man of 40 with a tumor the size of an orange, weakly adherent to the diaphysis at the lower end of the femur. The other was an adult man with an angio myxo-sarcoma on the great trochanter the size of a man's head. He had a recurrence two years after excision.

Curettage gave definite cures in about 40 per cent, two came to resection and four to amputation later. The most favorable in location were those in the femur and the most favorable type, the giant cell sarcoma.

The conservative operation par excellence for sarcoma of the long bones is resection. The results are good on the whole. Often it is necessary to do an almost total resection of a humerus, saving only the distal articular portion. Of the femur 25 or even 35 cm. have been resected. Complementary bone grafts are of course required in such cases.

Resections of the fibula have given the poorest results of any of the long bones, probably because more advanced cases have been attempted in that location. Here also the giant cell tumor has proved the most favorable type. Functional results of resections are generally good. The arm defect can be overcome by a prosthetic apparatus so that the hand may be almost normally useful.

Indications for the three types of conservative operations:

1. Simple excision of the tumor only when it has a pedicle and is not otherwise firmly attached.

2. Curettage is generally avoided because it is an incomplete operation, there is danger of causing diffusion of the sarcoma and it leaves a cavity which is easily infected. It may be done for giant cell tumors which have developed slowly as benign growths, or in case a patient refuses all other intervention, or in early growths which are very limited and well encapsuled, or in cases to be followed by Coley's serum.

3. Resection is indicated in cases of giant cell, spindle cell (pure or mixed), tumors of recent development, and those which are hard or limited by a resistant shell. Round cell sarcomas, those which are soft, ulcerated or infected and those of very rapid growth require radical operation. Resection is the operation of choice for the upper limbs, for even a flail shoulder, upper arm or elbow with preservation of the hand is to be preferred to radical amputation. For the lower limbs the functional results are probably not as good after resection as after amputation, everything considered. The leg will usually be shorter, there may be a persistent pseudo-arthrosis and it may be better to amputate and provide an artificial leg. This is especially true of the femur. Below the knee a bone graft may bridge the defect caused by resection and in some instances a fibula has been known to take on the function of weight bearing in place of the tibia. —*Dr. William Arthur Clark.*

THE TRIPOD METHOD OF WALKING WITH CRUTCHES. By Robt. W. Lovett, M. D., Boston.

Complete paralysis of both lower extremities is not a bar to some form of ambulatory activity. This has been demonstrated in infantile paralysis, and the same generalization can be extended to any flaccid paralysis resulting from fracture of the spine or gunshot wounds of the spinal cord. As the latter class of cases has been called to our notice by the war, a consideration of how these patients may be taught to walk is one object of this paper.

The two muscles most necessary to maintain the erect position are the quadriceps extensor femoris and the gluteus maximus.

In aiding patients to walk, with such a distribution of paralysis, if the knees are kept from flexing by simple splints, the loss of the gluteus maximus can be compensated for by a peculiar method of using the crutches for what may be called "tripod" walking. If the crutches are placed apart and slanted well forward at their lower ends, they form the two anterior points of a tripod, while the third and posterior part of the tripcd is formed by the body of the patient inclined frward at its upper part, with the feet well behind. The apex of the tripcd thus comes at the shoulder level of the patient, his body and legs forming the posterior support of the tripod, and the crutches the two anterior supports. Such a position is stable because (a) the base of support is a large triangle bounded by the three points of support of the tripod, and (b) the body is stable in the over-extended position because hyperextension of the hips is checked by the "Y" ligament of Bigelow, and, with the knees stiffened by braces, the center of gravity falls in front of the hip joints and keeps them extended and firm. A paralysed patient with no power below the waist can stand unsupported easily in this position, if there are no contraction deformities in hip, knee or ankle.

The patient must next be taught confidence in this position. If he has been long confined to his bed or chair, he will have lost his sense of upright equilibrium which must be dealt with by itself and restored by repeated practice in standing on crutches with support near at hand, or by standing with both hands resting on the foot rail of the bed. When he has acquired the sense of balance to have self confidence, he should begin progression. This is accomplished by hitching one crutch a few inches forward, then the other crutch, and then in cases of complete flaccid paralysis, jerking the feet forward together a few inches by a body movement, bearing down with the hands on a crutch bar and sliding the feet over the floor. If any degree of power remains in the iliopsoas muscles, which is often the case when the gluteus maximus and all muscles below it are paralyzed, the feet can be more easily advanced one at a time, only those patients affected very severely having to slide along with both feet together. Most patients without any power in the hip flexors are able to accomplish this advancing one foot at a time by a twisting of the body.

For holding the knees extended the Thomas caliper splint is used. Two uprights, one outside and one inside of the leg, pass from the shoe to just below the gluteal fold. They are shaped to the leg, and at the bottom each is bent to a right angle. The bent parts of the upright slip into a tube in the heel of the shoe. At the top the uprights are fastened to a posterior, flat, curved band passing just below the gluteal fold, and a fenestrated knee cap of leather holds the knee extended. The splints can be joined at the knees for greater comfort in sitting, but the joint must be provided with an automatic drop catch which locks when the knee is extended. The use of a pelvic band on the braces rests on no anatomic or mechanical basis and is never necessary.

If abdominal weakness is present, a cloth corset is advisable to support the abdomen and give greater steadiness.

In flaccid paralysis of the lower extremities it is a fact that any patient of average intelligence, with one good arm and one arm good enough to hold a crutch, can be made to walk, provided deformities of the hip, knee and ankle are not present, or have been corrected.—*Leo C. Donnelly, Detroit.*

THE ORTHOPEDIC TREATMENT OF A FEW REMARKABLE INJURIES AND DISEASES OF THE BATTLEFIELD. Dr. Carl Deutschlander. Archiv f. Orthopædische u. Unfall Chirurgie. XVII Band, 3 Heft 10. January 1920.

The scope and significance of the orthopedic treatment of injuries and diseases of joints, muscles, tendons and the other tissues of the extremities has fully been recognized and demonstrated in the recent war by the surgeons of all belligerent nations. This article gives additional proof of the importance of applying orthopedic principles in the care of various injuries and diseases, especially in fractures of the femur, amputations, flatfoot and "rheumatic" affections which have come under observation of the author in the field hospitals.

Fracture of the femur:

Reviewing the various methods of treatment of these fractures, the conclusion is reached that plaster of Paris, applied with skill and technical correctness, was the most efficient means to keep the corrected position of the reduced fracture, to immobilise the limb and to relieve pain during the transportation of the patient. The objections to the use of plaster of Paris are discussed, and it is mentioned that the plaster splint has been the method of choice with only few exceptions, such as severe infection of the wound, lack of material and time for the correct application of the splint. Under these conditions only have metal splints been utilized.

Amputations: Conservatism was the rule. After eliminating all sources of infection and combatting all its dangers, the object in all amputation cases was to create a stump which would give to the patient a functionally useful extremity with or without an artificial substitute. Precautions were taken against leaving too short a bone stump, against retraction and shrinkage of the soft tissues and their contracture and against needless severance of muscular attachments. The lower extremities were supplied with temporary prosthesis as early as three weeks after the amputation. Crutches were largely discarded and early mobilisation of joints instituted.

Flatfoot: Most cases of flatfoot developed in city dwellers. It may be regarded as a sequence of "city culture": lack of exercise, sedentary occupations, poor shoeing, and hard inelastic street pavement.

The method of treatment consisted in: rest, proper exercise and massage. More advanced cases received also baking in improvised apparatuses, gradual correction of the foot by means of adhesive strapping and bandaging. The arch support was, with only rare exceptions, entirely dispensed with.

"Rheumatic" diseases of the extremities: Under this heading are discussed: myositis, neuritis, neuralgia and the arthritides. Their treatment consisted mainly of the proper application of physical measures: heat, massage and graduated exercises.

By this early application of the orthopedic principles, most excellent results were obtained in reducing disability and in minimizing the time for functional after treatment.—*A. Gottlieb*, San Francisco, Calif.

Conditions that Simulate Tuberculous Disease of Hip. R. B. Wade, M. B. C. L. M. Sgd. *Medical Journal of Australia*, January 1920.

Difficulties that arise in the recognition of tuberculous hip joint disease are found only in the early stages.

Conditions simulating tuberculosis of the hip are changes in the periarticular tissues and in the joint itself. Of these there are—

Periarticular

1. Changes in the psoas sheath, which by reason of its passage over the joint will cause alterations in function, especially limitation of motion in certain directions.
2. During acute stage of infantile paralysis, may cause confusion by tenderness of affected muscles in this region.
3. Lesions of bone to which are attached muscles that control movement of hip joint. This is seen in tuberculous lesions of ischium or great trochanter.

Among the lesions of joint from which diagnosis must be made are—

1. Attenuated sepsis with delayed or modified symptoms.
2. Synovial inflammation of rheumatic nature.
3. Sprain fracture of adolescence. Trauma or simple coxa vara known as osteochondritis juvenalis.
4. Memory of organic hip joint trouble, seen in hysteria.

The outstanding points of tuberculous hip joint disease are—

1. History of previous injury.
2. Limp, due to flexion of thigh in order to take weight on balls and toes, thus lessening jar of walking.
3. Night starts are not often seen until late.
4. Pain referred to knee is not always found.

Examination reveals in supine position—

1. Flexion thigh with lordosis of spine when legs are straightened.
2. Flattening of lumbar curve when well leg is flexed on abdomen.
3. Limitation of motion in every direction, due to muscular tightening or guard action. Elicited by bending knee and flexing hip to right angle. Circumducted movements are limited in every direction.
4. Deviation to one side or the other, most often adducted.
5. Von Pirquet's reaction is found early. When positive without gross tuberculous lesions it may be assumed to be tuberculosis of the hip. If pain and limitation of motion in all directions is elicited, sure diagnosis can be made.

Among the pitfalls are—

1. Inflammation of psoas sheath, from
   (a) Abscess of Potts' disease
   (b) Appendicitis (rare)
   (c) Acute septic infection of psoas sheath.
   (e) Iliac glands

   Here flexion is seen without limitation of motion in all directions.
2. Tuberculous affections of ischium or great trochanter; cause limitation of flexion and rotation respectively.
3. Acute rheumatic infections are accompanied by high temperature and symptoms; and quiet down with short period of rest and salicylates.

4. Osteochondritis juvenalis or Perthes disease is extremely difficult, in early stages, to differentiate from tuberculosis of the hip. It is a chronic inflammation of the cartilage of the upper epiphysis of the neck of the femur, resulting in formation of coxa vara. These patients at no time show positive von Pirquet, and after a few months at rest, good movement is secured.

5. Coxa Vara, of rachitic origin, has no limitation of motion, being chiefly affected in abduction. An X-ray examination will clinch diagnosis.

6. Traumatic coxa vara results from strain or twist or green-stick fracture of neck of femur. Symptoms often simulate tuberculous disease of hip if untreated with coxa vara.

7. Septic infection of joint has early accompanying abscess with distinguishing pyogenic organisms in the pus. Also there is often early formation of bony sequestrum.

8. Hysterical hip can be determined by ruling out other troubles and by aid of x-ray and negative von Pirquet reaction.—*Dr. J. E. M. Thomson.*

Report on Joint Mobilization With or Without Inter-Position. Beitr. z. Klin. Chir. Vol. 117. No. 3 1919.

Under certain general pre-suppositions a new joint may form just as well without as with inter-position of soft tissues, such as hernial sac, pig's bladder, etc., which offer a material that becomes absorbed too quickly to be of importance in the formation of a new joint. The question of inter-position is consequently of minor importance in arthoplasty. The splendid results obtained by Payer and others, are not due to fascia inter-position but to excellent technic. The only draw back in the technic without inter position is the hemmorrage which may lead to organization and stiffening of the joint.

In regard to the technic, the author polishes the end of the bone with burr and reamer. Drainage is procured by glass drain. Steinmann extension is used for twenty four to forty eight hours after operation. Passive motion is begun on the fifth to seventh day.

Report on 16 cases with 20 operations: Fat fascia inter-position 3 cases: autoplastic fat 1 case; fresh hernial sac inter-position 3 cases, preserved sac inter-position 1 case; preserved amnion 4 cases; no inter-position, polishing method 8 cases.

Joints operated on: Ankle 2 cases, knee five cases; hip 2 cases; fingers and wrist 4 cases; elbow 3 cases; jaw 2 cases.

Results. Ankle: One fat inter-position, one preserved hernial sac, one fresh hernial sac, gave doubtful results. Knee: Amnion 2 cases, preserved hernia sac 2 cases, polishing method 1 case, all results apparently alike. Hip: Fascia flap 1 case, polishing method (no inter-position) 1 case. Both results alike. Wrist: Polishing method (no inter-position) 2 cases, fascia 1 case, fresh sac 1 case. Sac inter-position failure. Others alike and fair. Elbow: Polishing method 3 cases, result good in all cases.

The author feels that the no inter-position method is equal in value to the method of soft tissue inter-position.—*A. Steindler, Iowa City, Iowa.*

SUGGESTIONS FOR THE TREATMENT OF FRACTURES OF THE RADIUS AND ULNA OF THE MIDDLE THIRD. Charles H. Lemon, M. D., Milwaukee, Wisconsin. *Wisconsin Medical Journal*, 1920, Vol. xviii, No. 2.

Among the author's reasons for discussing this subject are the facts that (1) the modern text books do not intelligently treat fractures of the middle third of the forearm; (2) that, next to fractures of the hip-joint, these are the most difficult fractures to handle; (3) that they are very frequent in children between the ages of three and twelve; (4) that severe deformities are frequently seen after the usual treatment of these fractures by tbe application of anterior-posterior splints, either in pronation or midway between pronation and supination with the thumb up.

The forearm of a child is usually plump, the bones are small and the muscles in a developing stage, very active and bearing to each other the relation of two to three as between the extensors and supinators on the one hand and the flexors and pronators on the other. With these potential anatomical possibilities, a breaking of the bones of the middle third means a loss of balance, because the flexors immediately become the bow-string, tightening day by day, and produce mathematically certain shortening by flexion on a line drawn from the palm to the elbow.

It is an elementary principle in the treatment of fractures of long bones that in order to overcome overriding or bowing, the joints of either extremity of the long bone involved must be fixed by whatever apparatus is used for flexion. It becomes obvious that in fractures of the middle third of the forearm, not only the hand and wrist should be fixed, but also the elbow joint and at least the lower third of the humerus, the latter being used for extension.

The teaching of text books, that in the position midway between pronation and supination the radius and ulna are at their widest point from each other, is incorrect according to the writer's observation. Further, in that position it is impossible to determine whether the bones are apposed at the point of fracture, no matter how much extension and counter-extension is used.

Having in mind the difficulty of determining the opposition of the fragments in the semi-prone position, the neutralizing of the one-third greater pull of the flexor and pronator group, and being assured that the relative position of the bones as to distance from each other is greater than or equal to that in the semi-prone position, it has been the practice of the author to treat all these fractures invariably in the supine position. Plaster-of-paris is applied in the form of a circular cast from the knuckles to the middle third of the humerus, the plaster being reinforced at the point of fracture to twice the thickness of the rest of the cast. As the cast hardens the arm is extended on a flat table and the hand and elbow brought in contact with its surface, thus producing over-correction of the fragments and extension, and further equalizing the loss that will occur in the circumference of the arm, due to its shrinking as the swelling caused by the fracture gradually disappears.

During the first five days, while the swelling is at its height, coaptative splints should be used, the point of fracture being doubly padded to give correction. Due to the fact that many of these fractures are subperiosteal or greenstick, they are readily reducible.—*J. E. M. Thomson, Lincoln, Nebr.*

A Simple Clamp for Making Balkan Frames of Iron Pipe. By George T. Johnson, M. D., Terre Haute, Ind. *Journal American Medical Association*, May 1, 1920, Vol. 74, No. 18.

These clamps can be quickly made by any blacksmith, from material in general use. Each plant consists of an iron plate made of ⅛-inch sheet iron and two U-bolts. Four holes are drilled in the plate to admit the free ends of the U-bolts. The dimensions given are suitable for use with ½-inch pipe.

A joint made with these pipes will not slip under a great load. They will likewise fasten the upright pipes firmly to the ordinary iron bed. If it is desired to make the frame independent of the bed, crutch rubbers serve admirably on the lower ends of the upright pipes and prevent any possible damage to the floor.—*Leo C. Donnelly, Detroit.*

Osteomalacia, Is It a Rare or Rather Common Disease? By W. H. Dieffenbach, M. D. *Medical Record*, June 12, 1920.

From his experience the writer believes that a great many of the lesions of osteomalacia escape unnoticed until they become chronic. Very often the lesion is first diagnosed when spontaneous fractures occur. He believes that the disease is not an uncommon one, but is simply not recognized as a rule.

Aside from the Roentgen diagnosis which is typical and easily disclosed, there are sufficient clinical manifestations to diagnose the lesion in its early stages. These are the characteristic short unsteady gait, with bended back, the indefinite pains referred to different articulations, the excess of earthy phosphates in the urine, the frequency of the white lines of Sargent, white line occurring when skin is firmly stroked with a hard object such as finger-nail, caused by contraction of small blood vessels, and as the disease continues the diminution in height due to atrophy of bone or bending of the femur or other long bones. Osteomalacia simulates rheumatism and arthritic conditions and should be carefully excluded in these conditions.

The etiology, judging from the endemics in Central Europe points to undernutrition or improper nutrition with deficiency of lime, phosphorus and vitamines. Suprarenal, parathyroid, and gonad deficiencies are also noted in this lesion. Whether they are reflexly due to the above nutritional defects or are primary in character, remains to be determined.

Treatment by means of rest, actinotherapy, diet and endocrine products, especially in conditions not too far advanced, will be effective. There is hope for improvement in these patients if the basic cause is removed or ameliorated. —*Mark Cohn, M. D.*

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TRAUMATIC OSTEOMYELITIS AS SEEN DURING THE WAR

EDWIN W. RYERSON, M. D., F. A. C. S. CHICAGO, WITH THE COLLABORATION OF MAJOR JOHN P. BEESON, M. C., U. S. ARMY

More than two thousand cases of infected bone-wounds have been treated in U. S. Army General Hospital No. 28, Fort Sheridan, Illinois, since January first, 1919. These wounds were received in action at some period before the armistice, and are therefore to be considered chronic. In most cases they had existed at least six months before coming under the observation of the writers of this paper.

They may be roughly divided into two classes: those with severe and serious infection, and those with slight but persistent discharge from small sinuses, without severe constitutional disturbance. Primary debridement had in all cases been performed, and there had usually been at least three or four secondary operations for drainage or the removal of sequestra before they arrived at Fort Sheridan.

No reference will here be made to cases of ununited fracture, since this subject is not included in the present symposium, but the majority of cases of chronic osteomyelitis resulted from gunshot fractures which showed bony union at the time of entrance into General Hospital 28.

Patients with severe and serious infection were admitted to the surgical service, where they were treated by the Carrel-Dakin method, or by packing with Dakinized gauze, or, in some instances, by hot wet boric acid dressings. It was the general impression that the Carrel-Dakin method, carried out with the most painstaking attention to details, gave remarkably good results, and fully justified the enormous expenditure of time and labor which it invariably requires. It cannot be done properly except by espe-

cially trained and enthusiastic surgeons, and its technical and economic difficulties are such that it is sometimes unattainable. A very reliable substitute, in times of stress, was the practice of packing the wounds with gauze saturated with Dakin's fluid, after walling off the surrounding skin with vaselined strips of cloth. The wounds cleaned up rapidly, and healing progressed almost as well as under the Carrel technique. Both of these methods seemed to give better results than the wet boric acid dressings.

Most of the cases required operation of some kind, usually for the purpose of removing sequestra or foreign bodies, or to provide proper facilities for drainage. It was at first somewhat difficult to account for the very large percentage of patients with sequestra, and it was considered by some observers that the primary debridements had not been done with sufficient thoroughness, but it was later realized that most of these sequestra were due to necrosis of the ends of the bones with subsequent separation of small fragments.

In general, the severely septic cases cleared up rapidly, and were able to be discharged in a comparatively short time. The X-ray examination, carried out in all instances, was of the greatest value in determining the plan of treatment.

The cases of the second arbitrary class, with wounds entirely healed except for one or two small, persistent sinuses, were of very great interest. Many of them had been considered as healed with superficial ulceration, and the original bone injury had been forgotten, but it was astonishing to note the regularity with which the routine X-ray examination revealed definite deep pathology underlying the shallow ulcers.

More than seventy per cent of this class showed sequestra, a few had foreign bodies, chiefly shell-fragments, as the irritants, and approximately forty per cent had cavities in the bone which were incapable of permanent healing. Many of these latter also had sequestra within the cavities.

It soon became evident that all of these cases required operation, the sequestra and foreign bodies being obviously undesirable, and the cavities needing the special forms of treatment described by many surgeons overseas and popularized by such men as Dehelly, Depage and Chutro. This means, in effect, that the overhanging walls of the cavity must be cut away to such an ex-

tent as to leave only a shallow, saucer-like depression, into which the soft tissues can be made to fall. It may be necesary to remove a considerable portion of the cortex, even to the extent of materially weakening the structure of so important a bone as the femur, but experience has shown that sufficient bone growth will eventually take place to provide enough strength. This method, in the cases for which it is suitable, is extremely satisfactory, but there are many instances where it cannot be used, as, for example, in the immediate neighborhood of the joints. Here it would be impossible to remove the walls without opening into the joints, and some other method must be used. The transplantation of free or pedunculated masses of fat, sufficient to fill up the entire cavity, has been recommended by some authors, and it was tried in a series of cases at Fort Sheridan. It did not give good results, and has been abandoned by the writers of this paper. The best and most reliable method, in our experience, is the use of pedunculated flaps of healthy muscle, cut with as broad a base as possible, in order to provide sufficient blood-supply. These muscle-flaps have good resistance to infection, and rapidly become adherent to the walls of the bone-cavity. Several cases were observed where the lower end of the femur had been the seat of severe damage, one side having been shot away just above the condyle, with an osteomyelitis involving most of the epiphysis, but not extending into the joint. Here, obviously, no more bone could be removed at the lower margin without ruining the joint. The bone-cavity was therefore packed with Dakinized gauze until the bacterial count was reduced to a minimum, and a large flap of the vastus muscle was turned down and pressed into the cavity. It was fastened as well as possible by suturing its neck to the surrounding tissues, so that it could not retract, and the skin was loosely sutured over it. Drainage was always used. Considerable suppuration generally took place, but after a time complete healing resulted.

It is probable that this method should be more widely used in other portions of the bones, especially in the femur and tibia, since it would reduce the liability to fracture either during the operation or afterward, by rendering it unnecessary to remove important cortical bone.

Much interest has been aroused by the work of W. W. Babcock on the immediate sterilization and closure of chronic infected

wounds by the use of zinc chloride in connection with radical excision of the infected area. His results, as published in the Journal of the Am. Med. Assoc. of May 8th, 1920, certainly furnish a strong argument for the more extended trial of the method, but up to this time it has not been attempted by the writers.

Case Histories

O. S. B. X-ray No. 4122, wounded by M. G. B. Sept. 28, 1918 in left thigh, with fracture compound, femur, upper third. Admitted to GH28 June 20, 1919, with union, limited motion in knee and a discharging sinus. Operated July 14, 1919, sequestrectomy and bone saucerized. Did not heal and was re-operated March 13, 1920, old scar and sinus tract excised and bone again saucerized. Healed May 3, 1920 and was discharged May 25, 1920, with one inch shortening, knee flexion 45 degrees.

O. B. X-ray No. 5207, wounded Oct. 12, 1918 in right arm, fracture compound, humerus middle third. Admitted to GH28 Nov. 15, 1919 with union and discharging sinus. Operated Jan. 8, 1920, sequestrectomy, bone saucerized and muscle sutured into bottom of cavity. Still draining slightly June 1, 1920 but shows all signs of healing soon.

C. S. X-ray No. 2151, wounded Oct. 6, 1918 by M. G. B. through ankle. Admitted to GH28 April 9, with discharging sinus from internal malleolus and bony ankylosis of ankle. Operated June 5, 1919, tibia saucerized, external condyle and astragalus removed. Healed Dec. 26, 1919. Discharged March 25, 1920 with foot in good position and 15 degrees of movement in ankle.

A. H. T. X-ray 5037, wounded Sept. 28, 1918. With fracture, compound of femur, upper third. Admitted to GH28 July 28, 1919 with union, large draining sinus outer side of thigh. Knee fixed in 20 degrees flexion. Operated Aug. 16, 1919 sequestrectomy, bone saucerized. Discharged May 1st, 1920 with one inch shortening, movable knee, to 45 degrees flexion.

F. R. X-ray 1889, wounded Oct. 4, 1918, M. G. B. left thigh, fracture compound, femur middle third. Admitted to GH28 April 9, 1919 with union, discharging sinus posterior surface and stiff knee. Operated June 6, 1919, sequestrectomy and bone saucerized. Healed Feb. 23, 1920; discharged April 7, 1920 with no shortening and knee flexion to 110 degrees.

A. R. X-ray No. 1507, wounded Oct. 10, 1918, M. G. B. thru left leg, with fracture, compound, tibia, lower third. Admitted to GH28 March 25, 1919 with union, 2¼ inch shortening and discharging sinus. X-ray shows union of proximal fragment of tibia to distal fragment of fibula. No union of distal fragment of tibia. Operated Aug. 1, 1919, sequestrectomy and bone saucerized. Healed Dec. 30, 1919. Discharged May 11, 1920 with 20 degrees motion in ankle, and foot in good position.

J. J. P. X-ray No. 5615, wounded Oct. 4, 1918, M. G. B. right leg with fracture, compound tibia and fibula. Admitted to GH28 July 28, 1919 with union and discharging sinus. Operated Oct. 13, 1919, tunnel in bone exposed and roof removed and bone saucerized. Healed Jan. 17, 1920 with large adherent scar. Discharged Feb. 4, 1920, one-half inch shortening, no limitation of motion in joint.

All these cases had at least 4 previous operations before coming to Ft. Sheridan—primary debridement, and secondary sequestrectomies, etc.

DISCUSSION OF PAPERS BY DR. RYERSON AND DR. KIDNER*

Dr. Gaenslen: It certainly seems advisable to be on the alert for syphilis in all atypical cases. I recall two or three cases with unusual symptoms that came on gradually, with moderate temperature, pain and restlessness at night. One got the impression of a very mild osteomyelitis. I had one such case under observation, with involvement at the upper, outer end of the femur. Before I recognized the true nature of the lesion I had fixed the hip in plaster, because it seemed to represent a different type of case. Under fixation treatment, pain and temperature subsided, and the general condition improved. Later on there was multiple involvement of the metatarsal bones of the feet. The Wassermann test was found positive and mixed treatment was followed by marked improvement.

Dr. Rugh: There are two points to be noted in these papers; first: I noticed that many men who were drawn into the service, had been apparently cured of osteomyelitis for from three to ten years. These were chronic non-tubercular cases, which are generally considered cured when the sinus is closed, but when these men were put on intensive work the old sinus broke down. In other words, there is very little difference between tubercular osteomyelitis and the other suppurative forms. Second: I have not looked up cases like Dr. Soutter's, but I have seen two cases of primary osteomyelitis of the patella,—one in a boy, evidently of traumatic origin, the other in a woman of 22 years of age. The diagnosis was made after the X-Ray picture was taken. Sometimes this condition resembles a bursitis, rather than an osteomyelitis. In my two cases, one was operated upon and one was treated by fixation in plaster.

Dr. Orr: There is one point in technique which it is important to emphasize. In getting a good field for saucerization, I have often seen the retractor put under the bone in such a way that a pocket is left on the far side.

*Dr. Kidner's paper was printed in the August issue.

With a septic field there is likely to be a development of suppurative foci if this is done. One should be careful not to use retractors in this way.

Dr. Peckham: I have seen two or three cases of osteomyelitis unsuccessfully treated by the Carrel-Dakin solution afterward cured by ionic medication. In a two per cent solution of zinc sulphide there exists free ions of zinc, attracted toward the negative pole. Therefore if you apply zinc solution from the positive pole it is attracted toward the negative, the wave is between the two poles. These statements can be easily verified. These ions kill bugs and this can be followed under the microscope. If you saucerize your bone, and put a large electrode opposite the opening and a small one in the opening you can send a current through and the electricity kills everything. I have done this with success. You then operate and clean out your wound and make it dry. I have done the sliding skin flap and this obliterates all the spaces. Your case is then cured, (if you are successful).

Dr. Starr: I would like to say a few words on the point I made yesterday in the clinic. Dr. Kidner made a suggestion as to the method of introduction of infection into the bone. One reason why this subject should be discussed is that when we were getting up this symposium we wrote to several of the members to ask them to discuss the subject of acute osteo-myelitis, and we had at least a dozen refusals; the reason stated was that they didn't know anything about the subject. Therefore it is up to some of us to make a few observations. You can take any joint, such as the knee, that is a fairly common source of the infective process, this diagram shows the epiphyseal line with the periosteum inserted into the epiphyseal line, limiting the extent of the infection. For some unknown reason, the infecting osteomyelitis starts on the diaphyseal side of the epiphyseal line. Trauma is a difficult thing to lay one's finger upon, but this may be a reason why the blood stream lodges the infection in one joint rather than another. It does do so on the diaphyseal side, close to the cortex. The infectious process extends rapidly from this point. The diagnosis should be made within the first 24 hours. There is nothing else except cellulitis that simulates this condition. There is high temperature, high leucocytosis and marked pain with localized tenderness. The patient is severely ill. This condition would never occur except in osteomyelitis. You must relieve the tension and prevent infection from spreading into the cancellous tissue of the bone, and thus prevent the bone destruction. If the case is not diagnosed, the infection spreads through the cortex to the periosteum and this is raised. The medullary cavity is 2 or 3 inches above the line of infection and does not become infected for some time. Having found the localized point of tenderness, you relieve tension by a simple incision which will relieve pus, and a drainage tube put in then will stop bone destruction. If the case goes on for four or five days there is a large amount of pus under the periosteum. This causes destruction of the cortex and blocks off the blood supply, by obstructing the vessels. The question is what to do with these cases. It is difficult at operation to differentiate normal from abnormal tissue; you may leave infected tissue, or you may take healthy tissue away. If you have an extensive stripping of the periosteum with drainage, leave it alone until it has formed a sequestrum, then the involucrum forms of itself on the outside and the sequestrum is freed. Removal of the involucrum will expose the cavity and the sequestrum. You can wipe out the cavity and the wound will heal within three or four weeks. If it is more extensive, still leave it alone until the sequestrum has come away. If there is complete stripping of the shaft, so that the shaft is separated, it should be left alone until involucrum is formed, and then it can be removed. The subsequent recovery of the shaft will come from the stripped periosteum. New bone is regenerated from this periosteum so stripped, which carries with it some osteoblasts as a result of the inflammatory changes. The teaching of the text books is pernicious on this point. If you cut down to the periosteum and find no pus, the text-books urge you to go on, but you may find no frank pus anywhere along

the line, at any time; you should only incise until you relieve the tension. When you don't find anything, a few drill holes can be made in the section toward the epiphysis, thus establishing a line of least resistance, so that the infection will not spread to the medullary canal. The medullary canal in the early cases should never be chiselled into or otherwise opened up.

Dr. Ryerson (closing): It was to be expected that Dr. Peckham would spring something electrical upon us. I should not want to have my wounds Peckhamized. The cases I have mentioned are infected wounds of the bone and should not be treated as acute osteomyelitis. What our president has said about conservatism in the treatment of acute osteomyelitis is right. We have seen whole tibias and fibulas removed with the idea that new ones would grow. We have seen brand new tibias grow from something that was not the shaft of the tibia. I won't say the periosteum did it; but something did it! In acute cases we must drain; we must cut down at least to the periosteum. Dr. Starr says to drill the bone, but I should prefer to have a larger opening made when the X-Ray shows destruction in the shaft. I believe it is not wise to allow soldiers' wounds to suppurate if one can safely close them, on account of the possibility of amyloid degeneration. Cavities must be closed by filling in with soft tissue. Some men use skin, but I don't believe in it. It does not allow the bone to grow. I think soft muscle tissue is much to be preferred. I have seen several cases of Brodie's abscess. The patient has no external signs, and the X-ray shows slight rarification. The characteristic is in intense boring pain at night. I do not believe in Dr. Stern's method of scraping out. You do not need to take out every bit of osteogenetic material. The cavity can be gently cleaned out; then use the Carrel-Dakin method; then transplant muscle to fill the hole in the bone. The soft tissue filling will bring about healing of the abscess.

Dr. Kidner (closing): I agree with Dr. Ryerson, I do not want to ignore periosteum. I believe it does help in bone growth. Wide drainage and rest are the two things that cure osteomyelitis. Dr. Starr's drawing is a classic which should come before the whole country. Surgeons are everywhere cutting away too much bone in the attempt to find pus. I have not seen amyloid degeneration among soldiers. The less curettage one does within a bone cavity, the better the chance of regeneration.

Dr. Soutter: In osteomyelitis I agree with Dr. Starr that a sequestrum should not be removed until it has separated or has practically separated from the rest of the bone. The bone should be opened but not scooped out its entire length as is sometimes recommended.

In osteomyelitis, a great deal of the repair is helped by a good involucrum and the support which comes from the bone that will later separate and become sequestra.

The soft tissues should always be well drained down to the bone so that they do not become soaked with the discharge and lifted from the bone.

Dr. Starr: There are two points to be emphasized: there is danger in cleaning out the cavity too much. You have seen men curetting with absolutely no knowledge where the pathological tissue ends and the healthy starts. In filling up a cavity of that sort, muscle has a distinctly bactericidal effect in these cavities. Fat, in my experience, has proved useless.

PAIN IN THE GREAT TOE FROM ADHESIONS OF THE INTERNAL SESAMOID BONE

BY ROLAND HAMMOND, M. D., PROVIDENCE, R. I.

This is a report of two cases of pain in the great toe which proved in both cases to be due to adhesions between the internal sesamoid bone and the head of the first metatarsal bone. In both cases the pain was relieved by the removal of the sesamoid bone. In the first case the pain was felt on the internal surface of the first toe from the metatarso-phalangeal joint forward to the end of the toe; in the second case the pain was felt on the under surface of the first toe when bearing weight and was localized at the metatarso-phalangeal joint.

CASE 1. J. M., school teacher, was first seen July 2, 1918, referred by an orthopedic colleague. Two years before she had been treated for metatarsalgia with relief. Arch supports had been omitted and she had had no trouble until the autumn of 1917 when she began to have pain on the inner side of the right first toe. The toe was tender to pressure from the internal but not from the inferior surface. Examination otherwise was negative. X-ray plates showed bipartite sesamoids in both feet, and in addition a small area showing loss of bone just behind the head of the first right metatarsal. Within a week after her first visit the writer was ordered into active military service and the patient was transferred to Dr. Frank E. Peckham for further treatment. Proper shoes were prescribed, anterior arch supports were applied, and baking, electrical treatments and vibration were given without appreciable relief.

On returning to civil life one year later, the suggestion was made by Doctor Peckham that an operation upon the sesamoid bone might give relief, and concurred in by the writer.

OPERATION, JULY 8, 1919. Under a tourniquet a two-inch curved incision was made on the latero-inferior surface of the right first toe and carried down through the fascia. The tendon of the flexor longus hallucis was reflected to the outer side and the internal sesamoid bone, situated in the inner head of the tendon of the flexor brevis hallucis, was found adherent to the head of the first metatarsal bone. (Fig. 1.) Adhesions were freed up and the sesa-

moid bone dissected out. The outer sesamoid bone was found normal. Several minute, shallow depressions, slightly larger than the head of a pin, were found just behind the head of the metatarsal bone. There was loss of cartilage and the depressions were filled with detritus. It could not be determined that they had any connection with the adhesion of the sesamoid bone to the metatarsal. The wound was sutured in layers and the patient made an uneventful recovery. Some loss of sensation in the toe was present for about two months. Three months after the operation the patient was walking without pain and has remained well up to the time

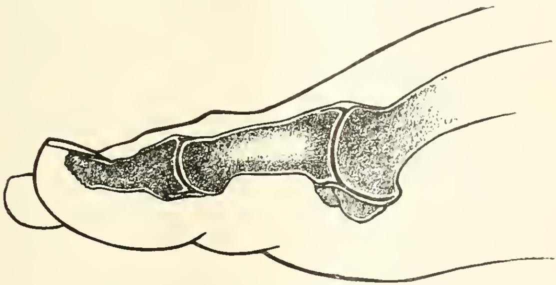

Fig. 1. Drawing showing normal relations of synovial membrane of first metatarso-phalangeal joint. In both cases the part of joint cavity between the metatarsal head and the sesamoid was obliterated and adhesions were present.

of the last examination, May 15, 1920. An anterior arch leather cuff was applied at the time when weight bearing was begun and worn for a few months, but this support has now been discontinued.

Case 2. M. M. 31, single, entered my service at the Rhode Island Hospital October 1, 1919 with the following history:

For the past three years she had complained of a constant dull pain on the under surface of the left great toe noticed when bearing weight. There was a small tender enlargement under this toe at the metatarso-phalangeal joint, which had increased in tenderness during the past two years. No other joint involvement. X-ray examination of both feet revealed no abnormalities of the sesamoid bones.

Operation, October 9, 1919. Under tourniquet a two inch incision was made on the latero-inferior surface of the left first toe

with the centre opposite the metatarso-phalangeal joint. The incision was carried down through the fascia, and the tendon of the flexor longus hallucis was reflected outwards. The internal sesamoid bone was found adherent to the head of the first metatarsal bone and was dissected out. The sheath was sutured in place and the fascia and skin over it. Stitches were removed on the thirteenth day and in one month she was walking without pain.

On May 8, 1920 she reported at my request and said that she had no pain in the right foot but that she now had a similar pain in the left first toe. The same operation was advised on the left foot. This operation was performed at the Rhode Island Hospital May 13, 1920. The antero-internal side of the internal sesamoid bone was found adherent to the head of the metatarsal bone lying just above it. A minute brownish spot showing loss of cartilage was seen on the metatarsal and a corresponding area on the sesamoid. The sesamoid bone was dissected out, and is submitted for your inspection. The wound was closed as in the previous operation. The patient is relieved of pain, but has not yet begun to walk and the result cannot be reported.

It has been possible to make a dissection of one foot from a recently amputated leg. The internal sesamoid was not adherent to the metatarsal but there was a small area showing loss of cartilage in the sesamoid which was not seen in the metatarsal. It is recognized that these areas of loss of cartilage do not necessarily possess any pathological significance.

In the literature which it has been possible to consult, no reports bearing on this subject have been found. Orthopedic confreres who have been consulted have not recognized the condition, possibly owing to the writer's feeble powers of description. It is hoped that the discussion may bring out reports of similar cases.

TECHNIQUE OF AN OPERATION FOR SPINAL FUSION AS PRACTISED IN MONTREAL*

BY A. MACKENZIE FORBES, LECTURER IN ORTHOPAEDIC SURGERY, MC GILL UNIVERSITY, MONTREAL

The operation of fusion of vertebrae for tuberculosis has now been practised for some years. The methods of Albee and Hibbs are well known. I think that the first operation which was performed for spinal fusion for the treatment of Scoliosis was originally described as having been performed in the Children's Memorial Hospital in 1913.

Some of us have been using another operation, not yet described, for fusing vertebrae for the treatment of tuberculosis and especially for fusion in selected cases of Scoliosis.

The third operation was originated because of the difficulties experienced in securing a sufficiently strong union between adjacent vertebrae, especially if it was desired to get union between a large number of vertebrae where the question of leverage as a possible source of weakness, in after days, had seriously to be considered.

The operation of Albee is an interesting one. Of course it is known that the bone graft of Albee cannot, in any sense, be considered as a splint. After the investigations of Gallie and Robertson in Toronto as well as the investigations of other well known writers it is generally conceded that the function of the bone graft is simply to promote osteogenesis. The osteogenesis which it promotes is in the bone into which it is inserted. As it is inserted into the spinous processes nothing but a long bridge of bone from spinous process to spinous process can be hoped for. The weakness of this as an immobilizing agent if used over a considerable part of the spine is easily realized when the mechanical principle of leverage is considered.

The operation of Hibbs is, in the opinion of the writer, a more exact and mechanically perfect operation than that of Albee.

*The original description of this operation was read at the meeting of the American Orthopaedic Association held in Toronto during the month of June, 1920. As many questions regarding the details of this operation were asked in the discussion which followed the first copy of these notes was subjected to the criticism of Doctors Royal Whitman of New York and Fred P. Yorston, of Montreal. Many of the suggestions of these surgeons for the elucidation of details have been incorporated in the description now being published. It is, consequently, hoped that it will be easily understood.

Here the articular processes between adjacent vertebrae are destroyed by means of a small curette. Here also the contiguous surfaces of laminae are so gouged and freshened that union between adjacent laminae can be hoped for. In this operation the spinous processes are turned down by means of a special cutting forceps devised by Hibbs in the expectation that these will become united and form a bridge of bone from vertebra to vertebra.

The operation of Hibbs is hardly open to the same criticism as that of Albee. At the same time if one performs this operation in the lumbar region, which is the region in which it is especially indicated in Scoliosis, one is impressed with the difficulty of bridging between the adjacent laminae by means of elevated fragments of bone turned up from the contiguous vertebrae because of the wide expansion between these vertebrae. The same holds good in turning down spinous processes. The space between the laminae and spinous processes of the lumbar vertebrae is so great that it is difficult to bridge by the method suggested by Hibbs.

We appreciate the pioneer work done by Albee and the mechanical perfections of the Hibbs operation. At the same time we contend that the stronger the fusion obtained the greater can be our expectation of success. For this reason we have devised the third operation which we now attempt to describe:

Broadly speaking, it may be said that the lumbar vertebrae differ materially in character from the dorsal vertebrae. Because the spinous processes and laminae of the dorsal vertebrae bear a different relationship to each other than do the spinous processes and laminae of the lumbar, different treatment must be carried out in these two regions.

The spinous processes and laminae in the dorsal region lie in apposition very much as the shingles on a wall, the upper part of the superior vertebrae lying, in each individual case, more superficially than the lower one.

On the other hand the spinous processes and laminae of the lumbar vertebrae do not lie in apposition to each other. Each one stands out as a separate and distinct entity and is well separated from its fellow by the soft parts.

OPERATION FOR SCOLIOSIS

A flap of skin sufficiently long to expose the area to be operated on is reflected from the concave side as in the Albee operation. The muscles on either side of the spinous processes are separated and are retracted exposing the laminae.

The supra-spinous ligament, the inter-spinous ligaments and other tissues between the adjacent spinous processes are removed. In the case of the dorsal vertebrae the following additional steps are carried out. The spinous processes and laminae are so gouged by means of a concave chisel that their cortical layers are separated from the medulla beneath and a series of chips of bone and periosteum are pried up along the superior and inferior surfaces of these parts of the vertebrae. These chips of bone are made to interdigitate with each other thus similar cortical chips or digitations from the adjacent vertebrae are so opposed that the new bone thrown out from the raw surfaces of the exposed medulla will unite in one bridge or band extending from vertebrae to vertebrae. In other words the laminae and spines in this region are in such close apposition that the interval between them is easily bridged by pushing the elevated fragments adherent to the periosteum alternately upwards and downwards from the laminae and spinous processes thus making a form of connecting trellis.

In the case of the lumbar vertebrae the following additional technique is required, as in this region the laminae and spinous processes are more widely separated than in the dorsal region.

The laminae of the lumbar vertebrae are so gouged by means of a concave chisel that their cortical layers are separated from the medulla and pried up along the superior and inferior surfaces of these parts of the vertebrae as practised in the dorsal vertebrae.

In the case of the spinous processes as these are more widely separated the connection is made more directly by splitting them vertically into several thin sections which are forced upwards and downwards and to the sides in order to inter-lock with those from the adjoining spinous processes and laminae.

In other words the spinous processes of the adjacent lumbar vertebrae are multisected into a petal-like formation extending in a vertical direction. The layers of petals are made to inter-lock or interdigitate with each other after having been depressed laterally

and made to lie layer upon layer over the laminae of the vertebrae which have been already freshened as described.

The spinous processes of the upper sacral vertebrae receives the same treatment. The lateral masses of the upper sacral vertebrae are turned over by means of a gouge from the caudal towards the capital extremity of this bone and made to cover the space between the sacrum and the fifth lumbar vertebrae and to interdigitate with the petals of freshened layers of bone above.

The erector muscles are then united over this oozing mass of exposed medullary layers of bone after drainage tubes have been inserted to care for future oozing. The skin is then united in the usual way and the wound dressed.

The patient then is laid in the prone position on a narrow hammock and placed in the position of greatest possible correction, and in this correction maintained by means of a plaster jacket in which the patient remains for six months.

This operation is not a simple one. It takes time to complete it and there tends to be much haemorrhage through venous oozing. There may be, also, some shock.

This operation should not be undertaken lightly, although in selected cases it will be found to have a distinct place. In the Children's Memorial Hospital, Montreal, we carefully choose our anaesthetist when performing this operation and impress the fact upon him that we prefer to complete our operation at a later date, if our patient shows any suggestive danger signal. Further in the case of an operation for the arrest of a progressive lateral curvature we always insist on performing the operation on the lumbar spine at one seance and that on the dorsal spine from three to six months later.

DISCUSSION

Dr. Galloway: I wish to disclaim any special qualification for discussing this subject. My experience has been limited and not of the kind to make me enthusiastic. I am frankly pessimistic regarding structural scoliosis. Five years ago I had a patient of seven, with severe progressive scoliosis after polio myelitis. There was a striking degree of difference in the deformity when lying down and standing up. It occurred to me that if I could ankylose the vertebrae in the position they assumed when the patient was lying prone, I could decrease the deformity. I had had no experience with this application of the Albee operation but the parents readily consented to my attempting to improve the child's condition. The result was an enormous improvement, and prevention of increase of deformity. Since then I have operated on several cases, some by the Albee method and some by the Hibbs method. On the whole I

think the Hibbs' operation preferable for this class of cases. I don't believe results will be good unless there is considerable reduction of deformity noticeable in the prone position. My first case proved more satisfactory than any of the subsequent ones. I believe it is necessary to ankylose practically the whole of the dorsal and lumbar regions to get the best results.

DR. FREIBERG: I have no confidence in the principles of the operation for scoliosis, and so have not done any. Dr. Albee is unsound in his reasoning. However much bone you stick in the unbalanced muscles must continue their pull, and even if you convert it into a poker back you will get recurrence of the deformity. I admire Dr. Truslow's optimism. I have tried this treatment for years; I have supervised gymnastics as he has. Cases have been carefully controlled in my office. I was convinced that the patients did not do their exercises well at home. I have come to the conclusion there was no such thing as corrective exercise. Correction of the deformity by plaster jackets is not to be measured in a short time, but perhaps years afterwards. Dr. Truslow measures by percentages; my measurements are by a scale of which 50 amounts to the same thing. You can easily see how much change has taken place.

DR. ADAMS: There are many cases of severe scoliosis that are due to infantile paralysis, many more than have been supposed up to the present. Whether this operation of fusion will be successful in these cases is yet to be proved, but it seems most hopeful from what I have had the chance to observe at the clinic of Dr. Forbes. Some years ago, I convinced myself that another large group of severe scoliosis were due to anomalies of the sacrum and the fifth lumbar vertebrae. Whether this fusing operation would be of any avail in this second type of case or not, I cannot be sure, but possibly it may be.

DR. FORBES (closing): The operative treatment for Scoliosis as suggested in the paper read by me is for selected cases only. In many cases of Scoliosis no non-operative treatment can be depended upon to relieve the deformity. In other cases, in spite of treatment, the deformity continues to progress. It is to be borne in mind that the deformity of Scoliosis in some cases is secondary to congenital and other lesions. The English School has drawn our attention to the number of cases of Scoliosis which are secondary to congenitally wedge-shaped vertebrae. Dr. Z. B. Adams of Boston has, amongst others, drawn our attention to the number of cases of Scoliosis in which the deformity is secondary to a congenital difference in the formation of the two sides of the last lumbar vertebra. There are many cases of Scoliosis which can be attributed to a paralysis due to Poliomyelitis.

In the Children's Hospital, Montreal, it has been noticed that those suffering from marked thoracic deformity rarely reach an old age. For this reason one is justified in adopting any method which will stop an increasing deformity. In other words we have to be satisfied with a certain degree of deformity. We often have to realize that we cannot attain a greater degree of correction. In such cases are we not justified in fusing the vetebrae in order to maintain the correction possible?

Doctor Freiberg seems to think that recurrence after fusion is inevitable. Quite possibly he is right, but there is no reason why we should not try to get fusion if this is indicated. I do not agree with Doctor Freiberg that recurrence is inevitable if it is possible to obtain a sufficient fusion. I have endeavored to secure fusion of the whole vertebral column by the production of a strong band of bone leading from lamina to lamina and spinous process to spinous process. I realize to what great strain this bridge or band of bone will be subjected in after life. It was because of the realization of this that we originated a new operation for fusion which we hoped could be more certainly depended upon than that of either Albee or Hibbs.

Doctor Freiberg takes a most pessimistic view, viz. that no progress has been made in our studies or treatment of Scoliosis within the past twenty years. I do not agree with him. I think that we know a great deal more about the physiology of the spine and about spinal movements today than we did even ten years ago. I think that Feiss began such a study, that others have carried on, and that, today, our knowledge of the physiology of the spine is very much greater than it was ten years ago. Of course truth is eternal, but our knowledge of truth is not eternal. In the case of Scoliosis our knowledge of the truth concerning it has been increasing within the past ten years. It is for us to apply our knowledge for the relief of or to help, those who are afflicted with this deformity.

Dr. Truslow (closing): I think Dr. Freiberg has studied this subject more fully than many other members. As to the question whether the exercises can be done at home or not;—I feel that I cannot spend more time than one morning a week with my scoliosis patients; but my gymnastic prescription is something I am proud of. Something is added each time; but not until I am convinced that previous work is being done properly. I can tell from the way the patient goes about it if he is doing it properly at home. These patients can't pay the fees if they come every day and would become discouraged at the expense. The question of measurement is a personal matter. What I present is easily made, quickly recorded, and valuable for deductions. I do not think rotation is always compensated by deformity elsewhere. One can with care bring about improvement in cases with as much as 25 per cent of rotation. It is true that these patients may die early, but with properly graduated exercise one can note improvement in the blood pressure and general condition. The question of paralytic scoliosis is very important. These deformities have occurred frequently since the 1916 epidemic and this is the cause of more adolescent scoliosis than we have been aware of. I try to make my patients optimistic. They will carry on the treatment longer if they take it in this spirit.

AN END-RESULT STUDY OF ARTHRODESIS FOR NON-TUBERCULAR AFFECTIONS OF THE HIP JOINT

BY H. W. SPIERS, M. D., LOS ANGELES, CAL.

From the Orthopedic Clinic of the Massachusetts General Hospital. A review of 34 cases operated there since 1908.

Operative relief of the stiff and painful hip of Non-Tubercular origin has not been given much consideration in the literature. This series was investigated at the suggestion of Dr. Robert B. Osgood. The operative work was largely preformed under the service of Dr. E. G. Brackett, whose method of approach was most frequently used. An effort was uniformly made to destroy the joint cartilage, to approximate the raw bony surfaces and to immobilize the extremity in the position of greatest functional value.

The questionnaire was worked out to discover as far as possible what the patient himself thought of the result, the length of his convalescence and his present condition as regards disability and self-support. The examination covered the questions of ankylosis, function and position. The records of the Out-Patient Department were studied to corroborate the report of the patient and also to get the surgeon's notes recorded from time to time during the period of the patient's ambulatory convalescence. The results were classified as Relieved, Partially Relieved, or Unrelieved and, as will be seen below, all fell definitely into one of these three classes.

Tabulation of the series is as follows:

Arthrodesis preformed since 1908	cases	34
Reported and examined	cases	25
Mortality	cases	2
Average age of patients	years	46
Youngest	years	22
Oldest	years	61
Average time since operation	years	$4\frac{1}{4}$
Hypertrophic Arthritis	cases	20
Traumatic Arthritis	cases	5
Gonorrheal Arthritis—died of shock	cases	1
Relieved of symptoms	cases	14
Partially relieved of symptoms	cases	7
Unrelieved of symptoms	cases	4

REPORTS OF PHYSICAL EXAMINATIONS.

Union firm	cases	17
Union questionable	cases	3
Non-Union	cases	5
Permanent flexion—varying from 10 to 60 degrees	cases	20
Abduction retained	cases	3
Neutral position	cases	4
Adduction assumed	cases	18
Rotation internal	cases	4
Rotation neutral	cases	5
Rotation external	cases	16

A study of the results of this series shows that there was a mortality of 5.9%. One case, a boy of 22 years with gonorrheal arthritis, died of shock shortly following the operation. The other case was that of an aged man who succumbed to pneumonia at the end of two weeks. The unusual gravity of operative interference in lesions in and around the hip joint is well recognized and the fact that the average age of these patients was 46 years, many were over 50, and, too, that complicating conditions were frequent does not make this mortality seem too high.

Ankylosis seemed to be attained most readily in those whose hip pathology was due to definite trauma. The five cases that come under this group all gave what was considered as a satisfactory end-result. These cases were found relieved of their symptoms and pursuing a gainful occupation. One of this number required a second operation due to an accident that occurred during his convalescence but in spite of this was found five years later, working as a laborer and having no symptoms referable to the hip.

The individuals operated upon for the relief of disability due to Hypertrophic Arthritis do not show so good a record. Of the 20 cases, 9 were relieved, 7 were partially relieved, and 4 unrelieved. The partially relieved group themselves around those who had doubtful union. The unrelieved all frankly did not get union. It would seem therefore, that if the ankylosis aimed at is attained, the end-result will be satisfactory. On the other hand, if the ankylosis is only partial, the relief will be doubtful. This type of arthritis is characterized by ebonization of the articulating surfaces and by its failure to produce union. It would seem, that if

the percentage of failures is to be reduced, a more thorough, radical, and destructive procedure must be carried out and the post-operative immobilization must be more prolonged in this type, than in arthritis of traumatic origin.

An effort was made to estimate the length of convalescence in these cases. One reported that he went to work in four months, a few were confined from five to seven months, but the remainder, where a satisfactory estimate could be made, were from seven months to a year or more in returning to their usual means of livelihood. It was interesting in going over the records in the Out-Patient Department that several complained that their results were unsatisfactory at the end of about one year, but reported relieved at the end of from two to five years. This is taken to mean that the ankylosis was only partial at the earlier date and consolidated later. The X-ray study of a number of these cases was not very satisfactory. The writer does not feel that much can be definitely said from the study of radiographs, concerning doubtful ankylosis in hip joints where bony over-growths are the rule.

The reports of the physical examinations are interesting. The extremity was immobilized in abduction at the time of operation and was held as far as possible in that position through the convalescent period for varying length of time. High double plaster spicas were used during the first weeks, followed by the single spica for the ambulatory fixation. In spite of this, only three of the series could be definitely said to be in abduction. The degree in these was only slight. Whether or not this was due to the fact that these were individuals who must, as soon as possible, be discharged from the wards and made more or less self-dependent, can not be said. There was undoubtedly a tendency to shorten the period of complete immobilization. Four cases showed the neutral position, the remainder, eighteen cases, were definitely in adduction. Regarding rotation of the limb, the report shows that the external position was retained fairly well. Only five were in the neutral position, four in internal rotation and the remainder, sixteen, in varying degrees of the external position.

The conclusions that seem justified from a study of this series are:

1. Arthrodesis for painful hips of traumatic origin gives a satisfactory end-result.

2. Arthrodesis for painful hips of Hypertrophic Arthritic origin are less satisfactory but justified.

3. The time of convalescence is a long one, approaching one year.

4. The tendency of the extremity is to return to the position of adduction and little should be promised in this regard.

AN OPERATION FOR THE RELIEF OF MEDIAN ANAESTHESIA

BY R. I. HARRIS, M. B., TOR. MEDICAL OFFICER, DOMINION ORTHOPAEDIC HOSPITAL. JUNIOR SURGEON, HOSPITAL FOR SICK CHILDREN, TORONTO.

In a considerable percentage of the peripheral nerve injuries received during the late war, it has been difficult or impossible to perform nerve suture, because of the excessive amount of tissue destruction. In such cases so large a gap exists between the ends of the severed nerve, that it is impossible to bring them into apposition. The outlook for recovery of nerve function is, of course, hopeless, and the patient must look in other directions than nerve suture for the relief of his disabilities. Secondary operations aiming at the removal of paralysis by tendon transplantation, have given splendid results in certain types of nerve injuries, notably irreparable musculo-spiral injuries. It would seem as though such secondary operations offer the only hope of improvement to the above mentioned type of patient. For this reason it is considered of interest to publish notes of a case of irreparable median injury, in which considerable improvement was obtained by means of a secondary operation.

Pte. C. was wounded in the left forearm on Sept. 2, 1918. He was admitted to the Dominion Orthopaedic Hospital, Toronto, on March 25, 1919—6½ months after receiving his wound. At that date his wounds were healed. The bullet had penetrated the forearm from front to back, severing the median nerve and fracturing the ulna. There was a non-union of the ulna at the site of injury, with loss of about an inch of the shaft. Examination of the median nerve showed all the signs of a complete section below the level of the fibres to the forearm flexors. These retained their voluntary power, and responded to faradic stimulation. The opponens pollicis was completely paralysed, and did not respond to faradism. An interesting anomaly of innervation was present. The superficial head of the flexor pollicis brevis, instead of being supplied by the median nerve, received its nerve supply from the ulnar nerve. It possessed voluntary power, responded to faradism, and contracted when the ulnar nerve was stimulated by faradism at the elbow. Because of the insertion of this muscle into the outer

sesamoid bone at the metacarpo-phalangeal joint of the thumb, he was able to oppose the thumb to the fingers, in spite of the paralysis of the opponens pollicis. The median area was completely anaesthetic. Trophic and vaso motor changes were very marked. The whole median area was cold and cyanosed. The tips of the index and middle finger were badly ulcerated from a burn. The ulceration was more severe in the middle finger, in which the terminal phalanx was exposed.

The diagnosis on admission was therefore—ununited fracture of the left ulna, and section of the median nerve below the level of the branches to the long flexors of the fingers and thumb.

By April 15, 1919 the ulceration of the middle finger had extended so as to involve the distal interphalangeal joint. It became necessary to amputate the terminal two phalanges. This operation was performed April 17, 1919. At the same time the median nerve was explored. It was found to be completely divided about 1½ inches above the wrist. The segments of the nerve were separated by a 3 inch gap. It was not possible to obliterate this gap even by extensive freeing of the nerve and flexion of the elbow and wrist. The wound was closed without further interference. The stump of the amputated finger healed slowly and with difficulty because of the impaired circulation due to his nerve injury.

The outlook for the patient was bad. He had already lost part of a finger from ulceration following an unperceived burn. There was every reason to believe that he would continue to suffer from unperceived burns, or in winter, from frost bites. The hand was completely useless to him because of the anaesthesia of this important sensory area. There was no possibility of recovery of median function because of the impossibility of performing nerve suture. Our experience with nerve grafts for the filling in of large gaps between nerve segments has not been satisfactory, and we have abandoned this procedure. Under these circumstances there was conceived the idea of implanting the radial nerve into the lower median segment, in the hope that the fibrils of this purely sensory branch of the musculo-spiral would grown down the neurilemma sheaths of the median nerve and find new end organs in the skin of the median area. It was hoped that this would restore sufficient sensation in the median area to improve the condition of the man's hand. The anaesthesia of the radial area which

would of necessity follow, would not be serious because the area is small and unimportant. Such an operation seemed particularly suited to this patient because, as mentioned above, he still possessed the power of opposing his thumb, due to the anomalous innervation of the superficial head of the flexor pollicis brevis. Impairment of sensation was therefore his worst disability.

Accordingly, on June 19, 1919, an anastomosis of the radial nerve into the median was performed as follows: A linear incision on the dorsal surface of the lower end of the radius exposed the radial nerve between the tendons of the supinator longus and the extensor carpi radialis longus. The nerve was cut off at the level

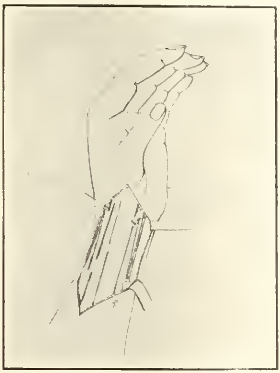

Fig. 1.

Diagram of the operation performed.

of the base of the metacarpal bone of the thumb. The lower segment of the median nerve was exposed by a second incision on the anterior surface of the wrist. It was freed and the end cut back until fresh fibres appeared. A tunnel was burrowed with Mayo scissors through the subcutaneous fat, from the upper end of the dorsal incision to the lower end of the anterior incision. Through this tunnel the radial nerve was passed. This brought the prepared ends of the radial and median nerves in contact, and rendered end to end suture easy. Suture was performed with inter-

rupted perineural sutures of fine catgut, and the site of suture was covered with a section of vein which had been slipped along the radial nerve previous to suture. The diagram explains the operative procedure.

On July 10, 1919, one month after operation, he still had complete median anaesthesia. The extent of the anaesthesia to pin prick is indicated in Fig. 2. About the middle of August (two months after operation) he stated that sensation was returning in the palm of his hand. Examination at that time appeared to confirm his statement, but the diminution was slight and no positive conclusions were drawn from the examination.

Fig. 2.

Area of anaesthesia to pin prick one month after operation.

Fig. 3.

Area of anaesthesia to pin prick 3½ mos. after operation.

On Oct. 6, 1919, 3½ months after operation, there was a definite diminution in the area of anaesthesia as is demonstrated in Fig. 3.

On Nov. 29, 1919 the gap in the left ulna was filled in with a bone-graft. From that date until March 1920 his forearm and hand were in plaster, so that progress of the recovery of the anaesthetic area could not be observed.

On March 15, 1920 (8 months after operation), there was a surprising diminution in the area of anaesthesia (See Fig. 4). Sensation had returned to the whole median area with the exception of small areas on the tips of the thumb, index and middle fingers. A curious and interesting feature was the fact that on stimulation of certain parts of the median area with a pin, the pin-prick was felt, not at the actual point of stimulation, but at the base of the thumb posteriorly, that is, in the radial area. This phenomenon was most constant on the index finger at the line

Fig. 4.

Area of anaesthesia to pin prick 8 mos. after operation.

Fig. 5.

Area of anaesthesia to pin prick 11 mos. after operation.

where the sensitive area passed over into the anaesthetic area—and this was presumably the area which had most recently recovered sensation. In the palm of the hand where sensation had been present longest, stimuli were accurately localized. Trophic and vasomotor changes had almost disappeared. There was no longer cyanosis and he no longer suffered from the extreme stasis and icy coldness which had been so bad a feature before operation.

Since March there has been a slow but steady improvement in sensation. On May 25, 1920 (11 mos. after his operation) there remained anaesthesia of only the tips of the index finger and thumb. The usefulness of his hand has greatly improved in correspondence

with the improvement in sensation. He can use the hand for the performance of all the simpler needs of daily life and there is reason to believe that if improvement continues his hand will ultimately closely approach normal.

In discussing this case it may be well to recall the conditions which exist in irreparable sections of the median nerve. Of all the peripheral nerve injuries, this is probably the worst, because the paralysis and anaesthesia involve the most used fingers. Even if the injury is below the level of the fibres to the flexors in the forearm, as was the case in this patient, there still exist two extremely damaging disabilities, viz. 1. Anaesthesia of the palmar surface of the thumb, index and middle finger and the radial half of the hand; and 2. Paralysis of the opponens pollicis with consequent inability to oppose the thumb to the fingers.

Through the sensory area supplied by the median nerve we are accustomed to receive the vast majority of our most important tactile impressions. The finger tips, and especially the tips of the thumbs, index and middle fingers, by years of training, have become highly specialized organs of touch. Through them we receive impressions of all those fine differences in the shape, texture, surface and temperature of objects, the perception of which constitutes the special sense of touch. Anaesthesia of the median area therefore means loss of the most important path of entry of tactile stimuli. As a result of the anaesthesia there are also lost all those fine movements of the fingers whose co-ordination is dependent upon tactile stimuli—for example, writing, the use of fine tools, buttoning clothes, etc. Moreover, these fingers, now insensitive and unable to protect themselves from trauma, are constantly being burned or frozen. They seem to be liable to injury by less extreme degrees of heat and cold than normal fingers, for a frosty day, which does no harm to a normal hand, often produces a bad frostbite in anaesthetic fingers, no matter how warmly they are wrapped up. The blood supply to such anaesthetic fingers is extremely sluggish, and ulceration resulting from injury is therefore extremely difficult to heal, and often leads to loss of a portion of the finger.

The median nerve normally supplies three small muscles in the hand, all associated with the thumb, and situated in the thenar eminence; the opponens pollicis, the abductor pollicis brevis, and the superficial head of the flexor pollicis brevis. Of these three,

the opponens pollicis is by far the most important. Abduction of the thumb and flexion of the thumb at the metacarpo-phalangeal joint, the functions respectively of the abductor pollicis brevis and the superficial head of the flexor pollicis brevis, are also performed by other muscles, so that in the event of median paralysis, these movements of the thumb are not entirely lost. On the other hand, opposition of the thumb, that is, rotation of the thumb about its long axis so that the pulp of the thumb faces the tips of the fingers, is

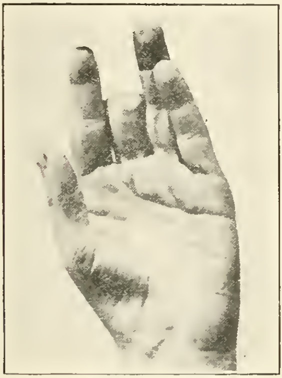

Fig. 6.

To show the atrophy of the thenar eminence due to paralysis of the opponens pollicis and the well-defined ridge formed by the belly of the superficial head of the flexor pollicis brevis.

Fig. 7.

Showing the amount of opposition of the thumb produced by the superficial head of the flexor pollicis brevis.

performed by the opponens pollicis only. In median paralysis this movement is lost. The importance of this special movement of the thumb cannot be over-estimated, since it is essential to finger tip prehension, the more important of the two types of grasping.

In a certain percentage of cases, of which the patient under discussion is an example, the fibres supplying the superficial head of the flexor pollicis brevis run with the ulnar nerve instead of with the median. As a result, when the median nerve is sectioned, this muscle retains its voluntary power, and being inserted into the outer sesamoid bone at the base of the proximal phalanx of the thumb, it is capable of producing a considerable degree of opposition of the thumb.

The accompanying photographs of the hand of the patient under discussion (Figs. 6 and 7) show this well. Fig. 6 shows the atrophy of the thenar eminence and the belly of the superficial head of the flexor pollicis brevis standing out strongly and running to its insertion in the outer sesamoid bone. Fig. 7 shows the extent to which the thumb can be opposed by this muscle. For practical purposes those patients who have a low median injury in the presence of this anomaly suffer only from median anaesthesia. They are therefore particularly suitable cases for the operation herein described.

The ease with which the brain of the patient readjusted itself to appreciate the new source of sensations is a matter of considerable interest. Until the time of operation all impulses passing up the radial nerve came from the posterior surface of the hand at the base of the thumb. After the operation a sudden change was made and stimuli from another area passed up these same fbres and were received in the brain by cells which hitherto had received impressions from the radial area. Yet in a comparatively short time the brain readjusted itself to interpret correctly the new origin of these sensations. In this connection it is of interest to note that during recovery, localization was not accurate in the area in which sensation had most recently returned. Stimuli were often referred to the radial area. Yet after a time localization became accurate in these areas.

In conclusion it may be stated that the operation described in this paper appears to offer a means of alleviating one of the worst disabilities of irreparable median injuries, viz. anaesthesia of the palmar surface of the thumb, index and middle fingers. It it only succeeds in restoring sensation to a degree sufficient to prevent unconscious burns and frost bies, it will be of considerable benefit. The approach to normal which this patient presents leads one to believe that a very considerable restoration of function is possible. The end result after the operation will be best, of course, in low median injuries, because in these, flexion of the fingers has not been lost. Function should be particularly good in those cases of anomalous innervation of the superficial head of the flexor pollicis brevis, by means of which opposition of the thumb is retained. But any case of irreparable median injury would be greatly improved by restoration of sensation.

HYPERTROPHY OF THE HEAD OF THE FIFTH METATARSAL

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During the last six years my attention has been arrested by a deformity of the foot which, so far as I can ascertain has escaped description.

This abnormal condition is a hypertrophy of the head of the fifth metatarsal bone, accompanied by certain symptoms which appear to be related to this enlargement. The swelling may be uniform producing a bulbous appearance of the bone when seen in an x-ray, or it may occur only on the outer side of the head of

Abnormal Foot—Note bulbous appearance of head of fifth metatarsal and prominence on outer side of foot.

the bone, the inner side being unaffected. In either case the heads of the other metatarsal bones remain unchanged, the quadrilateral form being retained in the unaffected bones.

Atrophic changes in the head are sometimes observed as shown in the rarefied appearance of the head in Roentgen negative. The outer side of the head is prominent over the fifth, and is sensitive to pressure, and the patient complains of the friction of the shoe

Normal Foot—Note rounded head of fifth metatarsal, and straight line of outer side of foot.

at this point. The little toe is sometimes inclined inward toward the fourth, giving the appearance of deformity similar to hallux varus on the inner side of the foot, but to a lesser degree. The cause is unknown, but in the first person observed, appeared to be due to friction on the part. The patient was a young gentleman of good family, who, while a student in Switzerland, had suffered severely with the cold, and first noticed the deformity when he had rubbed his stockinged feet together for a long time in an effort to restore the temperature.

I have observed the same deformity in an Irish servant girl, whose feet were very broad, and whose muscles were powerfully developed, and in whom I attributed the deformity to the friction of too narrow shoes. The deformity, well developed, does not disappear until cured by surgical operation.

The operation I have found most satisfactory is the removal of the outer segment of the spherical head. The joint is exposed by the longitudinal lateral incision; the capsule is incised, and the outer portion of the head is removed with a curved chisel from the proximal toward the distal ends. If the chisel be used in the other direction, or toward the heel, the shaft of the bone may be split, and the healing be retarded as in one of my own cases. After the removal of the bone the synovial membrane should be closed with a subcutaneous catgut suture, and the skin with silk gut suture. A plaster cast is not necessary.

This operation I have found satisfactory, and there have been no relapses.

ARTHROPLASTY OF THE KNEE JOINT

BY PUTTI—TRANSLATED FROM THE ITALIAN BY DR. P. BLANCO.

Ollier in his early work on the knee joint was confronted with two problems: 1. Restoration of function. 2. Stability of the joint. He thought that both problems could be solved by the following methods of procedure: 1. Sufficient resection of the articulating surfaces. 2. Interposition of membrane in the joint resected. 3. Preservation of all periarticular structures, especially the ligaments. The last thing could be accomplished satisfactorily by a subperiosteal approach to the joint. This method has stood the test and is used by the author.

Pathology Present in Ankylosed Knee: 1. Changes in the bony part of the joint which cause more or less union between the articulating surfaces. 2. Changes in the periarticular tissues which per se invite the fusion of bony tissues. In an ankylosed joint, especially of long standing, all trace of capsule, ligaments, and synovia may be considered virtually gone.

With simple resection a joint cannot be reconstructed. There must be the interposition of a membrane. The result, a neo-arthrosis, resembles very much the production of ununited fracture by interposed soft parts.

Experiments on the knee joint by Segale show that the removal of capsule is followed by formation of a new capsule from the tissues immediately surrounding the joint. Therefore the necessity of preserving all the periarticular tissues. The stimulus derived from function of the joint so treated is essential in the formation of a new capsule and in the differentiation of the foreign tissue placed in the joint, into the function of synovia. Verneuil was the first one to suggest the use of muscle tissue for arthroplasty of the temporo-maxillary joint. Ollier set down the following requisites for arthroplasty: 1. Sufficient resection of bone. 2. Separation of the resected surfaces and interposition of tissue which does not ossify. 3. Methodical immobilization. Ollier in his early work on arthroplasty conceived the use of periosteum for membrane.

To get a neo-arthrosis it is necessary not only to do a simple resection of joint, but to destroy all of the intra-articular structure, namely—capsule, ligaments, and synovia.

Concerning the use of pedunculated and non-pedunculated flaps, experiments show that a piece of fascia not pedunculated introduced into a joint will grow and will resemble in many ways the histology and function of hyaline cartilage under favorable stimulus, namely, physiological function of the joint; that free fascia transplanted on resected surfaces under the worst functional conditions and environment, will be alive three years after the transplantation; that it has been transformed into a tissue much similar to that which it has attempted to replace, namely, synovia; and that it prevents the formation of new bone from the resected surface.

Indications for Arthroplasty: Success dependent upon experience of surgeon. The attitude in which the joint is ankylosed does not contra-indicate arthroplasty, but the etiology is important. Joints of tuberculous origin should be left alone regardless of a few successful cases that may be reported. (Baer, Lexer). In all other cases of ankylosis which are not tuberculous arthroplasty may be done only: 1. After a thorough clinical and x-ray examination. 2. After sufficiently long time has passed for the inflammatory condition to be completely eradicated and there is no evidence of activity in the joint itself. In gunshot wounds of joints virulent organisms may preserve their latent virulence. This is true more of the knee joint, which has a large surface and is anatomically convenient. Wait a long time for intervention: at least one year. All wounds and sinuses must be healed and there should not be any joint sensibility. Children and old people are not good subjects for arthroplasty of the knee. Best age limit from 20 to 40 years. Hypersensitive, nervous people, or those who are not interested in the success of the operation, had better be left alone. Ankylosis due to pyogenic infection of the joint is best adapted for arthroplasty. Payr thinks that fibrous ankylosis is best adapted, but this is not so, because in these cases the joint is especially tender and not able to stand the post-operative treatment. Gonorrheal arthritis is not suitable for arthroplasty because: 1. Marked joint changes, and 2. the gonococcus will remain in the tissues a long time and will flare up under slight pro-

vocation. Many of the author's gonorrhoeal cases showed typical subacute inflammation of joint following arthroplasty. Ankyloses from chronic polyarthritis are not suitable cases because: 1. Marked atrophy of muscles. 2. Poor general condition of the patient. 3. The articulating surfaces are much deformed and facetted. 4. The fascia is also atrophied and suitable flaps cannot be obtained. Traumatic arthritis is suitable.

Operative Technique: Scrupulous asepsis. Use of Esmarch bandage. Bleeding comes mostly from resected bone and scar tissue. Use modified Kocher incision. Murphy's and Payr's double lateral incision is no good because there is not sufficient exposure. The Kocher incision is prolonged below to reach around the tibial tubercle; this allows of rolling in the skin after the insertion of the patellar tendon has been removed with the tibial tubercle. The piece of bone removed should be 4x3 cm., and 1 cm. deep. Solid union of this afterwards is indispensable. Some difficulty is often found in obtaining union of this tubercle afterwards due to poor bone circulation and because only skin and connective tissues cover it. This is the weak point of the modified Kocher incision used by the author. Another procedure which may be used instead, is that of lengthening the quadriceps tendon through a curved incision. The exposure is excellent, no bone is separated, and the divided tendon heals fast. After the insertion of the patellar tendon is freed, detach the patella from the femur; then retract the skin to the inside and expose the ankylosed joint. Sometimes the joint line cannot be seen. The end of the femur and tibia should be rounded so as to approach the normal shape as much as possible; the spine of tibia should be made sharp and the intercondyloid groove deepened. Preserve as much as possible the transverse diameter of condyles, but decrease the sagittal diameter. The ankylosis is destroyed by chisel, beginning on the external condyle and working in. Do not carry chisel to posterior side of knee because of possible injury to structures in the popliteal space. Do it by manipulation. Remove enough bone so that there will be 1 cm. separation between surfaces. Smooth the resected surfaces with a file. In ankylosed flexed knees, a cicatricial mass usually grows in the popliteal space. This should be removed.

Use of Fascial Transplant: It is better to have both resected surfaces covered, although one is sometimes enough. No ad-

ditional interposition of fascia between patella and femur. Use the free transplant and not the pedunculated flap.

Concerning the Patella: Except in those few cases in which there are no adhesions to the femur, or in those cases of ankylosis with the knee in acute flexion, the patella constantly increases in thickness, sometimes twice the normal. This interferes with motion at the knee. Chisel off excess of thickness. Complete removal of patella should never be done. Before the skin is sutured, put back in place with metal nail the ligamentum patellae and tibal tubercle.

Lengthening of Quadriceps Tendon: In cases in which ankylosis is in full extension or in slight flexion, it is difficult even after resection to flex the joint; in these cases lengthen quadriceps tendon through Z-shape method.

Post-Operative Care: For fifteen days immobilize the whole leg in a plaster gutter splint in semiflexion and apply from four to five kgm. traction to the leg. This attitude of limb is the best for physiological rest. This initial immobilization is done to insure complete healing of skin wound since much of the success in arthroplasty depends on clean, rapid healing of wound. Delay in mobilization of joint does not affect result. Post operative success depends upon the interest of the patient. After stitches are removed the limb is taken out of the splint, and with strap and pulley the knee is suspended to overhead frame. The free end of the strap the patient holds in his hand. Flexion at knee by pulling on strap; extension by releasing the pull. The frequency and duration of these exercises depend upon 1. Physical strength of patient; 2, his ability to stand pain; and 3, the reaction of the joint to motion. Later on the traction is removed; the patient is allowed to sit on edge of bed, lets the limb hang out at the knee, and by gravity flexion at knee is obtained. After one month, when the tibial prominence is fixed, more intense physiotherapeutic treatment is begun; massage of whole limb, especially of quadriceps; faradism, heat, and mechanotherapy. Heat, besides relieving pain, produces hyperemia. For the use of mechanotherapy and heat combined, use Bonnet's apparatus. Besides the above treatment, automobilization is essential towards the last. Do not allow patient to walk before one and one-half months. At first, use stiff leg brace until patient has enough confidence in walking. If progress

in the range of motion is arrested, apply cast in extension or flexion as the case may be. In exceptional cases, manipulation under ether is necessary. Three months for good use of limb.

Reports on Ten Cases

Oldest, 29 yrs.; youngest, 16 yrs.; average age, 22 yrs.; largest range, 100°; smallest range, 50°; average range, 82°.

Lessons Learned from Report of Cases

1. Complete removal of all intra-articular structures is necessary.

2. The operated knee is usually larger than the other from hypertrophy of tissues.

3. Operation too soon after acute inflammation in joint has subsided means failure.

4. In gonorrheal knees with arthroplasty the post operative care should be gentle. They take longer for good results.

Book Review

The following letter from the publishers is an excellent description of the new French system on Reparative and Orthopedic Surgery.

Paris le 30 Juillet 1920

Monsieur,

Nous vous signalons que nous vous avons adresse pour compte rendu dans votre Revue le "*Traite de Chirurgie Reparatrice & Orthopedique*" que nous venons de publier.

Nous esperons que vous pourrez consacrer a cet ouvrage une analyse en rapport avec son importance et sa portee. C'est en effet *la premiere fois* que, en France ou dans le Monde, parait un ouvrage de chirurgie reparatrice ou orthopedique applique au traitement des grands traumatismes, des malformations acquises, des sequelles laissees par les accidents du travail et qu'a ces questions ont ete appliquees les methodes nouvelles elaborees pendant la guerre.

Les noms des cinquante collaborateurs, qui ont realise cette oeuvre et qui tous sont des specialistes eprouves, sont la sure garantie de la valeur de ce livre considerable qui marquera une date et un moment dans l'histoire de la chirurgie.

C'est dans cet esprit que nous le recommandons a votre attention. Nous vous remercions des maintenant de l'effort que vous ferez pour nous aider a faire connaitre cette oeuvre qui est le fruit d'un labeur collectif important, et qui resume, pour l'avenir, une experience cherement acquise.

Veuillez agreer, aves nos remerciements anticipes, nos salutations distinguees.

MASSON & Cie

Fifty surgeons, many of whom are already well known to Americans have collaborated to give us an exhaustive treatise on the surgery of injuries and functional, as well as anatomical, restoration. The work is incomplete in that almost no attention is paid to the physiotherapeutic and occupational therapeutic methods which the French, themselves, used during the war. It is exhaustive in respect to description of war and industrial injuries and their treatment by the methods of the French.

Many British and American methods of established utility seem to have been omitted or over-looked.

The second volume concludes with a valuable and interesting review of pension laws of France.

Editorial

In his presidential address before the American Surgical Association,* Dr. Brewer has suggested that there shall be a new factor in the organization of the Medical Corps of the United States Army. Account must be taken, he says, of what the Army Medical Corps required and will require again of civilian surgeons in time of war. It is proposed that an organization of civilian surgeons be made at once and that an official head of the organization be placed in the office of the Surgeon General at Washington.

Dr. Brewer takes the ground that the "Consultant" plan in the A. E. F. was a measurable success. The writer of this editorial (although a consultant himself) will go further and say that the consultant, though sometimes wrong and often misunderstood, was a necessary factor in what was accomplished both at the front and in base hospitals overseas. What was accomplished could not have been done without him.

Peace time organization and training of surgeons for military duty has even more to be said for it than military training of our youths in High Schools and Universities. Many of the shortcomings of surgeons in the military hospitals were due to inadequate peace time training and bad professional, (or unprofessional) habits acquired before the war. Training and organization for better military service might give us better service at all times. Dr. Brewer's plan will tend toward this.

Dr. Joel E. Goldthwait of Boston, chief consultant in Orthopedic Surgery, A. E. F., remarks in regard to the above that consultants for the different areas should be chosen on the basis of special training, age and physical fitness. The two latter qualifications must have special consideration for officers to be sent to the front. Dr. Nathaniel Allison of St. Louis, who was associated with Dr. Goldthwait and consultant to the First Army, points out the importance of having medical officers continue in the Reserve Officers Corps. Dr. Allison says, "This must be done by all responsible surgeons who desire to influence preparedness for the medical service."

*The Duties and Responsibilities of the Civil Surgeon When Called to Active Military Service.—By George Emerson Brewer, M. D., of New York, N. Y. Annals of Surgery, Aug., 1920.

News Notes

The Canadian Department of Soldiers Civil Re-Establishment in Ottawa has just published an interesting and instructive pamphlet. This department with a smaller problem than the United States, has done in many respects, better work than ours. Those who saw the Orthopaedic Hospital in Toronto and the instructive film showing the work of some of the divisions were much impressed, not only with the fine service provided for care of the wounded in hospital, but for the progress made in real reconstruction and re-establishment of the wounded in civilian life.

Classes for Crippled Children.—The sum of $258,245 was requested for the classes for crippled children in the New York City public schools for 1921. This was reduced to $44,000, which was provided. The number of classes was reduced from thirty-six requested to nine. Provision was made for five additional classes for children with speech defects in the elementary schools. A class in each of the training schools for teachers, for the instruction of prospective teachers for correction of speech defects, was allowed. Medical Record, July 17, 1920.

Dr. Gustav Zander died recently at Stockholm. He was eighty-five years old.

Twenty-two Clinics for crippled children have been established in Illinois. Dr. C. W. East, head of the division of child hygiene of the state board of health is in charge of the work. The Clinics have a total attendance of 1,600.

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Beninde—The Spread of Bone Disease Incident to the Hunger Blockade in Prussia. Veroeffentl a d geb d medicinalvereo, 1920, X, 121.

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Current Orthopaedic Literature

The Results Obtained in the Treatment of Chronic Arthritis by the Removal of a Distant Focus of Infection. Herbert Chapman. San Francisco.

A review of the status of focal infection and joint lesions, referring to work of Billings, Rosenow and others. The cases are divided into groups according to location of the focal infection. Fifty per cent of cases of chronic arthritis, treated at the Leland Stanford clinic, in which the removal of focal infections was done, were definitely improved as observed clinically. Twenty-one cases under personal observation of the author showed definite improvement in 76.2 per cent, no improvement was seen in 19 per cent, and 4.8 per cent were worse after treatment. The most striking results were obtained in the group of cases in which the focus of infection was in the genito-urinary tract, which need long and faithful treatment. In cases where the teeth were the location of the infection very rapid improvement was noted. Removal of the tonsils aided a small group of patients where tonsillectomy was indicated.—*Hall.*

Sciatica from an Orthopaedic Standpoint. *Medical Record.*

J. Appleton Nutter, after recounting very briefly some of the views regarding the origin of sciatica, and reporting four cases traceable to remediable orthopedic conditions, such as faulty posture, flat feet, arthritis deformans of the spine, cites other causes of the disease. Lesions of the hip-joint (among which arthritis deformans is the most commonly found); new growths; tuberculosis; injury of the bones of the lower spine or pelvis; multiple sarcomatosis with sciatica due to pressure in the pelvis; any form of pelvic disease capable of causing pressure on the sciatic nerve, to which may be added gravid uterus; psoas abscess; varicose veins inside the sheath of the nerve; syphilis, which is more likely to be present as a meningitis, as an arthritis of the lower spine, or as a periostitis, though true gummatous neuritis is possible; gonorrhea, acting commonly through the medium of an arthritis, though gonorrheal neuritis has been described; and variations in the lower spine may give rise to sciatica. In the differential diagnosis the writer warns of the pains of tabes. Sciatica is also fairly confused with hip-joint disease. It sometimes simulates the painful spasm of the peroneal muscles which so often accompanies a rigid flat foot. The pain seen in the calf of the leg which accompanies intermittent claudication has been mistaken for sciatica, as also that due to varicose veins. The treatment depends upon the cause. Tonsils, if diseased, may need removal, abscessed teeth may need extraction, a chronic prostatitis may need treatment. An arthritic spine needs fixation, a relaxed sacro-iliac joint should have efficient support, disease of the hip-joint calls for immobilization. All these measures will be found to have a marked effect upon the pain. For the affected

limb absolute rest is essential, pillow fixation as a rule being found useful. For the pain, acetyl-salicylic acid is useful, as also the salicylates and drugs of the coal-tar class, such as phenacetin. Counter-irritation over the course of the nerve is valuable. The Paquelin cautery is very useful and should be used only very superficially. The application of mustard and the use of blisters may give relief. The injection of sterile water, alcohol, or weak cocaine solution into or beside the nerve is not often practised, as permanent damage may be done. Nerve stretching is no longer in favor, and properly so in the writer's view. In subacute cases baking and massage will generally be found useful. Hydrotherapy is sometimes of value, but like electricity more often gives only temporary relief. The injection of sterile water into the epidural space of the sacral canal has given relief which has lasted several hours or even longer. It is a procedure easy of accomplishment and unlikely to result in damage to the nerve.

A CASE OF SNAPPING KNEE (GENOU A TIROIR.) R. Proust and R. Soupault. *Revue d'Orthopedie*, March 1920.

The authors' case, a man of 27, showed numerous deformities. He was afflicted with a deformity of the skeleton and the soft parts of the right forearm; with a fracture of the right humerus, the right femur and a backward dislocation of the left knee, all as a result of injury sustained nine years before. The knee presented normally no changes in contour; but it could without pain or force be brought into position of considerable genu valgum, whence it could be reduced under distinct cracking sound. In right angle flexion it could also be brought into position of backward dislocation and would snap back into normal position when the contracture of the flexors of the knee subsided. In extension the knee assumed the position of genu recurvatum.—A. *Steindler, Iowa City, Iowa.*

THE DIFFERENT TENDON OPERATIONS FOR THE RELIEF OF PERMANENT PARTIAL OR TOTAL MUSCULOSPIRAL PARALYSIS. Mauclaire. *Revue d'Orthopedie*, April 1919.

The article contains a very complete synopsis of the different tendon operations in musculospiral palsy, beginning with the first tendon transplantation carried out by Drobnik in 1894.

The method of Sir Robert Jones is described more in detail.

Author's modification consists in volar incision in midline and detachment as low as possible of the following tendons: Flexor carpi radialis, Palmaris longus and Flexor carpi ulnaris; dorsal incision and, if necessary, plication of the extensor tendons; passing of flexor radialis and palmaris longus around the external and of the flexor ulnaris around the internal border of the forearm suture of the tendon of the Flexor ulnaris to the ulnar tendons of the extensor

digitorum communis, and of the tendons of the flexor radialis and palmaris longus to the radial tendons of the extensor communis.

According to this technique nothing is done to replace action of the extensors of the wrist.—*A. Steindler, Iowa City, Iowa.*

ANTERO-EXTERNAL DISLOCATION OF THE PATELLA. J. Murard. *Revue d'Orthopedie*, April 1919.

Following the report of a case the author, in discussing this condition calls attention to a number of interestng points. In order to bring about the dislocation a relaxation of the patellar tendon is necessary. This relaxation is furnished at the moment of the injury by the outward rotation of the leg on the thigh, or inward rotation of the knee. Another fact is the rotation of the patella which is explained by muscle action of the quadriceps at the moment of displacement. The reduction in the case reported was easy. It was carried out by direct manipulation, without force, by gentle pressure from outside inward. Late results of the reduction were not observed.—*A. Steindler, Iowa City, Iowa.*

TRAUMATIC LATERAL DISLOCATION OF THE SECOND LUMBAR VERTEBRA. REDUCTION BY TRACTION UNDER ANAESTHESIA. Guyot and Mauclaire. *Revue d'Orthopedie*, April 1919.

The authors report a case of traumatic dislocation of the second lumbar vertebra, sustained by a fall from a street car. The X-ray showed a complete lateral dislocation between the second and third vertebrae.

The right lower limb was totally paralysed, with hyperaesthesia most marked on the back of the foot, the anterior portion of the leg and thigh.

Plantar, Achilles and cremaster reflexes were absent.

On the left lower extremity, the motility of foot and leg were preserved, with a certain weakness of the extensor muscles of the leg. Plantar and cremaster reflexes were preserved, Achilles and knee reflexes absent.

The reduction was carried out under anaesthesia by both longitudinal and lateral traction, the longitudinal traction preceding, and being followed by lateral traction after ten minutes effort.

The very violent pain in the left lower extremity disappeared after reduction.

In the course of three to four months the right limb showed a marked return of motion in the extensors and flexors of the toes and abductors of the hip. On the left side motion had become normal. Sensibility on the right was normal to touch, and almost so to pain and heat. Reflexes were absent. On the left sensibility had become entirely normal, and reflexes were present with the exception of the plantar reflex.

The report is of considerable interest because of the completeness of the dislocation and the remarkable return of motor and sensory function. The low seat of the injury, below the level of the conus terminalis, involving only the nerve bundles of the cauda equina, accounts for the extraordinary result.—A. *Steindler, Iowa City, Iowa.*

TREATMENT OF SCOLIOSIS. E. Estor. *Revue d'Orthopedie*, April 1919.

The study of scoliosis which some years ago had commanded considerable interest has been practically abandoned during the war.

While the method inaugurated by Abbott has not quite justified its early expectations, yet it has taught us a number of important physiological facts and, with more or less modifications it is still finding followers among a number of orthopedists.

The author, reasoning from the transition of the physiological into the structural stage of scoliosis, adopts the forward flexion as a means of reducing deformity. In order to obtain the corrective effect of forward flexion the following exercises are advised:

1. Forward flexion of the trunk with extended knees, the fingers reaching within 10 cm. from the ground.

2. Elevation of the arm opposite the curve.

A platform mounted with a gaspipe frame is used for the maintenance of these positions.

In the subsequent application of the plaster cast the author follows essentially Abbott's technique. His observations are too recent to allow of definite conclusions. He is able to attest, however, that he has arrived with this method at results superior to any obtained heretofore.—A. *Steindler, Iowa City, Iowa.*

LUXATION IN THE FIRST TARSOMETATARSAL JOINT. By Reinhold Girgensohn. *Deutsche Zeitschr. f. Chir.*, Bd. 149, Heft ½., S. 135, 1919.

The literature of the dislocation of the first tarsometatarsal joint is reviewed and it is stated that only 26 cases have been reported.

The author adds his case to these statistics and gives the history as follows: A boy of 11 was riding horseback and fell together with the horse. The horse landed on his left foot and leg, and produced by the force of gravity the luxation in the tarsometatarsal joint. Reposition was impossible and extirpation of the internal cuneiform became necessary. The foot was immobilized. The result was perfect.

In nearly half of the cases a fall from and with the horse was given as etiology, because only through an excessive action of force is the production of this dislocation possible. This force acts in a longitudinal direction to the metatarsal bone. While the thrown off rider rests on the ground on all fours; forearms and hands in front, knees and balls of the big toes behind, the fall-

ing horse strikes the foot and presses it in the direction of the long axis of the first metatarsal. The metatarsal dislocates, in most of the cases, dorsally; in a few cases the internal cuneiform breaks or becomes crushed.

Reposition of the dislocated metatarsal is simple if no cuneiform fracture has occurred; in the latter case the cuneiform must be extirpated before reduction is possible.

The prognosis is good, as a rule. Perfect anatomical and functional result is obtained, provided the foot is early mobilised.—*A Gottlieb, M. M., San Francisco, California.*

On the Sunlight Treatment of Surgical Tuberculosis. By C. Bruening. *Dtsch. med. Woch.*, 1920, No. 1.

Under the most favorable conditions for heliotherapy, the author has made observations which are of value as a contribution to the teachings of Rollier of Leysin (Switzerland). In a hospital in Constantinople which was located on the seashore where the air was permanently clear, the sun constantly shining with intensity, the author has had excellent conditions for this treatment and an abundance of material. The results, in bone and joint-tuberculosis were however discouraging. Contrary to Rollier, Bruening has treated almost entirely adults, only very few children were under his observation. Further, these adults were undernourished and in a poor state of general health.

The author comes to the conclusions that heliotherapy is a valuable adjunct in the treatment of tuberculosis, but that it should not be regarded as an "all-healing measure," which makes the other, known and recognised, measures unnecessary; that sufficient nourishment is of much higher importance in the healing of tuberculous processes and that the air in a high altitude is more valuable than the rays of the sun. Heliotherapy may be regarded as a contributory aid in the fight against tuberculosis but its value must not be overestimated.—*A. Gottlieb, M. D., San Francisco, California.*

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The Journal *of* Orthopaedic Surgery

THE ABDUCTION METHOD CONSIDERED AS THE STANDARD ROUTINE IN THE TREATMENT OF FRACTURE OF THE NECK OF THE FEMUR.

BY ROYAL WHITMAN, M. D., NEW YORK

Read at a Meeting of the American Orthopedic Association June 9, 1920.

The purpose of treatment of a fracture is to restore function. For this, the essentials are correction of deformity, fixation of the fragments until security is assured, supplemented by protection during the period of reconstruction.

This purpose has never governed the treatment of fracture of the neck of the femur—ostensibly, because the mechanical conditions made it impracticable or because it would endanger life or because the tissues being incapable of repair, it would be futile. Actually, because the means at command have been inadequate to apply it. This statement may be easily verified since the basis of all treatment in common use is traction on the limb. Traction, if properly applied and supervised, may be efficient in the treatment of fracture of the shaft of the femur because the tension on the ensheathing muscles aids in alignment and because security is soon assured by external callus. It is not efficient for fracture of the projecting neck because it can at best appose the fragments in a lateral, and therefore, insecure relation. Repair is not aided by external callus but must proceed from the interior and it requires, therefore, the quality of fixation that can only be assured by direct pressure.

The adaptation of the rules of practice to defective mechanics, the point of view from which the treatment is considered, and the results estimated may be illustrated by quotations from representative writers on fractures.

"Restoration of form and function is rarely to be attempted or even sought."

"The first indication is to save life, the second to get union, the third to correct or diminish displacements."

"It is a crime to disturb an impaction in reasonably good position."

"Intra Capsular fractures practically never unite by bone."

"Our prognosis must always be unfavorable. In many instances, the injury soon proves fatal and in all, the functions of the limb are forever impaired—no matter whether the fracture has taken place within, or external to the capsule, whether it has united by ligament or bone, shortening of the limb and lameness are the inevitable results."

Under these conditions treatment has always been perfunctory in character. This is best illustrated in hospital practice but apparently it is no more efficient in the country at large, since it is stated that of 120 cases of ununited fracture at the hip observed at the Mayo Clinic not one had been treated properly at the time of the injury. The results, as compared to those of other fractures, are extraordinarily bad, yet paradoxical as it may seem, these results are the chief support of the treatment that produced them because they are accepted as evidence of incapacity for repair and therefore of the futility of surgical efficiency.

The abduction treatment presents an absolute contrast in every particular to conventional teaching and practice, because it is based on adequate mechanics. By this method, fracture of the neck of the femur is treated on surgical principles and as the fracture above all others in which the result is most directly determined by character of the treatment and by the skill of the one who conducts it. It displaces, therefore, not merely conventional methods as inadequate to apply these principles but all the theories, customs and traditions that have served thus far by confusing the relation of cause and effect to uphold incompetence and neglect. Radical and revolutionary as the statement may appear, it is in substance, simply that opportunity is essential to repair—that since conventional treatment is inadequate to assure this essential, conclusions based on the results are of no scientific value.

It is from this standpoint, as the exponent of reform, that the abduction treatment is presented for consideration, and as such, a sketch of its evolution may be of interest.

Its inception dates from 1890—when the first of a series of cases of fracture of the neck of the femur in childhood was identified. At that time, the fracture in early life, now known to be not infrequent, was mentioned in treatises as a surgical curiosity and supposed to occur only as an epiphyseal separation, on the assumption that weakness at this joint could alone explain an injury which was characteristic of the atrophy of old age. In the cases first observed, the fracture was incomplete, the repair was rapid and the immediate results were classed as good because the effect of deformity on function had not then been analysed. Further observation through a period of years brought to light the important fact that the deformity of the neck of the femur, now familiar as traumatic coxa vara, caused direct disability by limiting the range of motion and that in this class of cases, it was progressive, requiring eventually operative relief, indicating therefore, that it should have been corrected at the time of the injury, had there been any means for its accomplishment. It was further demonstrated that conventional treatment was almost equally inadequate for complete central fracture, although there could be no question of the capacity for repair. If therefore, children suffered the same penalties as adults for defective treatment, it was evident that defective treatment rather than defective nutrition must be the primary cause of failure both in young and old.

It was not until twelve years later that the abduction method was devised. It was first applied in a class of cases in which technical efficiency was the only consideration, then tentatively to those of the less favorable type, until it has now been demonstrated by the experience of eighteen years that repair under all conditions is primarily a question of opportunity. The only question is, whether the patient is of the operable or inoperable class. Personally, I do not admit an age limit for repair, and I believe that a treatment which relieves pain, prevents bed sores, and holds out to the patient a prospect of restored function is, as a rule, more conservative from the life saving standpoint, than neglect and its consequences.

The purpose of this paper, however, in the interest of prac-

tical reform, is to establish an efficient treatment for fracture of the neck of the femur in the class of cases now inefficiently treated, a vital issue that must not be obscured by discussion on the limits of its practicability. The abduction treatment is doubtless familiar to members of this association and I shall present only a brief sketch of its principles and of the manner in which it is applied.

The patient having been anaesthetized is placed on a pelvic support with a perineal bar, the shoulders resting on a box of equal height. Two assistants make manual traction on the extended limbs, drawing the perineum firmly against the bar and

reducing the shortening on the injured side, as demonstrated by measurement; the surgeon meanwhile lifting the thigh upward if it is below the plane of its fellow. The limb is then rotated slightly inward, thus completely apposing the fragments. Both limbs, extended and under manual traction, are then abducted to the full limit, on the sound side first, to demonstrate the normal range and to balance the pelvis. When this limit is approached on the injured side, the tension on the capsule aligns the fragments in a horizontal plane, and as the inner, or head fragment, is fixed by the acetabulum, finally forces the neck fragment against it. This mutual pressure is the first essential of stability, and it is further assured (in central fractures) by the inclusion of the line of fracture beneath the acetabular rim, by the apposition of the trochanter and the side of the pelvis, and finally by the absolute muscular impotence incidental to complete abduction. A long plaster spica is then applied which by fixing the limb in complete abduction, full extension, and slight inward rotation, insures the continued effectiveness of the anatomical splinting. If the fracture is incomplete or

impacted, the neck in its relation to the shaft, is usually displaced backward and downward, and whenever the deformity is sufficient to seriously impair the normal range of motion, it should be corrected.

In most instances, by the manipulation described, the shortening of the so-called impaction may be as easily reduced as if the separation were manifestly complete. If, however, the resistance is greater as in the incomplete fractures of childhood, or when treatment has been delayed, manual traction is supplemented by downward pressure on the projecting trochanter and more effectively by natural leverage.

For since the range of normal abduction is dependent upon the upward inclination of the neck of the femur, its depression must limit abduction by contact with the upper border of the acetabulum. This contact fixes the neck and by the leverage of the extended limb against this fulcrum the limb may be abducted, and then rotated inward to the required degree. In other words, the displaced neck is in a relation to the acetabulum, which under normal conditions would require abduction and inward rotation of the shaft. To correct the deformity, therefore, one must adjust the shaft to the neck by inward rotation and abduction of the limb. The plaster spica is then applied, assuring immediate fixation. Correction of deformity in this manner far from obstructing repair, is the most effective means of promoting it, since restoration of the normal contour apposes the fractured surfaces, which were separated by the distortion.

The subsequent treatment is the same for all forms of fracture. The head of the bed is raised one or two feet, an inclination which as contrasted with that required for traction, is far more comfortable and because of its influence on the blood supply more favorable to repair. The patient is turned at intervals from side to side and completely over to the ventral position, without discomfort or danger of displacement, thus bed sores and hypostatic congestion may be prevented. If feasible, patients may be transported daily to the open air and fixation in the abducted attitude even permits locomotion without injury, as has often been demonstrated by young and unruly subjects. The spica is retained for from eight to twelve weeks, or until it may be assumed that union is sufficiently firm to permit movement of the limb. On

its removal, the patient should remain in bed, devoting if possible several weeks to muscular re-education and to the restoration of motion, in the disused joints, the limb being drawn out to the limit of abduction at regular intervals by the attendant.

Weight bearing is not permitted until free and painless movement and X-Ray examination indicate stability of repair. Thus what may be termed the physiological treatment of fracture of the neck of the femur of the ordinary type is rarely completed within a year, and if early locomotion is desired, a protective hip brace should be provided.

It may be noted that the abduction treatment applying surgical principles is conducted with a definite purpose, whose initial attainment may be demonstrated by X-Ray examination at the time of the operation and at intervals thereafter, and that from beginning to end the patient is under single control.

Because of the changes of posture that it permits, it has, as has been stated, a wide range of adaptability as regards age, while from the practical standpoint, it has an even stronger claim.

There is at present no adequate provision for these patients in hospitals, consequently the great majority must be treated at their homes. Under these conditions, the advantages of the abduction treatment are decisive, since if properly applied, it requires only supervision, supplemented by the quality of nursing usually at command. Conventional treatment on the other hand, if conducted with a pretense of surgical efficiency requires constant and skilled attention, much of which is expended on the prevention and care of bed sores.

In other words, fracture of the neck of the femur in the great majority of cases may now be treated like other fractures in entire disregard of the qualifications and conclusions of conventional teaching—and relatively speaking with the same prospect of success. This proposition has been supported not only by my own experience but by that of many others. The latest evidence on the point is presented by one of our own members in a report on 70 cases treated by the abduction method, (W. C. Campbell, Annals of Surgery, Nov. 1919) the majority of the patients being over 60 years of age. Seven of these were too recent to report. One could not be traced and there were five deaths (7%). Twenty-eight of the fractures were intra-capsular (central). Of these

twenty-four recovered with bony union and good function (89.2%). Similar results were attained in all the cases of the extra capsular type a total of 94.9%. "In the majority of cases a slight limp persisted but quite a number walk perfectly."

These statistics compared with those of the British Committee on fractures show a balance of 70% in favor of the abduction treatment.

The progress of reform has been slow, not because of active opposition but because of the apathy and indifference of the profession to a neglected injury. For this the teaching still following the old tradition is directly responsible since it presents no standard to which the advocate of efficiency may appeal, no incentive to energy nor penalty for incompetence.

It may be of interest to note in this connection that Sir Astley Cooper classed the neck of the femur with the patella and olecranon as bones, which when broken, united by ligament, primarily because contact of the fragments could not be maintained. He thought it important to establish this fact otherwise a disabled patient might think himself entitled to legal redress.

Now that the means are at command to appose and to maintain contact of the fragments, this suggestion is entitled to serious consideration, for the Surgeon may now be held responsible, if not for success, at least for the opportunity, which if lacking, determines failure.

THE CAUSES OF SUCCESS AND FAILURE IN TENDON TRANSPLANTATION

BY NAUGHTON DUNN, BIRMINGHAM, ENGLAND

Read by Title at the Meeting of the American Orthopedic Association, Toronto, June 1920.

Mr. President, Ladies and Gentlemen:

I would first wish to express to you my very sincere appreciation of your invitation to read a paper before the American Orthopaedic Association.

The subject I have chosen for my contribution is one on which I think we have all much to learn.

The degree of deformity following paralysis usually bears a direct relation to the loss of muscular balance. Where paralysis is complete there is usually little deformity beyond that resulting from the action of gravity. This in the case of the lower limb may be aggravated by the strain of the ligaments in supporting body weight.

Extreme deformities are always associated with unequal muscular control—the limb being drawn towards the stronger muscles. These shorten, the joints become distorted and much disability and deformity result from misdirection of the power which is present.

The aim of the Orthopaedic surgeon is to restore muscular balance.

Tendon transplantation should result in improvement of function both by weakening a group of muscles associated with the production of the deformity and by replacing or reinforcing the action of one which is lost.

Many of the tendon transplantations proposed and practised fulfill only one of these objects. They are apparent successes in that they have lessened the tendency to deformity, but although their new insertion is soundly established the patient is unable to direct them to their new line of action.

We are I think agreed that for successful tendon transplantation, after preliminary correction of the deformity, a certain technique in the operation is essential. The transplanted tendons

should run a direct course to their new insertion, they should be sutured under moderate tension, and they should not be subjected to strain until their union with the receiving tendon or bone is assured. Perfect asepsis is also necessary.

On looking back on a fairly considerable experience of tendon transplantation, I am convinced that success or failure has depended mainly on another factor—the possibility of re-education of the transplanted tendon to perform its new function.

The constancy of success in certain operations and the equal certainty of failure in others, has satisfied me that something more than the mechanical possibility of the operation is essential. My experience has been that where a single tendon has been taken to replace one of its own group, success has been the rule, but where a single tendon has been used to replace one not normally in action with it, failure has resulted.

I would therefore suggest that two axioms in tendon transplantation should be: (1) That a single tendon or part of a tendon should only be used to replace one of its own group i. e. one normally in action with it. (2) That a group of muscles but not an individual member of the group may be used to replace muscles not normally in action with it.

I do not assert that an individual tendon cannot be trained to functionate in a group with which it is not normally in action, but, for this, very special attention to re-education, and the active co-operation of an intelligent patient are necessary.

These desiderata are not always possible, so that the surgeon will usually prefer an operation in which they are not essential.

The re-education of an individual tendon to act apart from its group would appear to be more practicable in the upper extremity where the action of the individual muscles is more specialised.

The movements employed in locomotion are, however, simple and controlled by groups of muscles, so that it is more difficult to re-educate an individual muscle to act apart from the group with which it is normally in action.

We therefore find that in the lower extremity the limitations of successful tendon transplantation are more clearly defined.

Where there has been paralysis of the quadriceps, transplantation of the biceps has not in my experience resulted in voluntary

control of the movement of extension—whereas implantation of an active sartorius into the quadriceps and patella has always resulted in improvement in function. The sartorius in these cases is normally in action in the attempt to extend the knee in walking and by transplantation only becomes more effective.

When we come to deformities of the foot following paralysis of one or more muscles, the evidence in favour of the axioms I have formulated is more striking.

There are here for practical purposes only two groups of muscle—one group the anterior tibial in action in dorsiflexion of the foot—the other the peroneal and posterior tibial muscles associated in action in plantar flexion.

We find that any of the anterior tibial muscles may successfully replace one another e. g. the tibialis anticus to the outer side of the foot or the peroneus tertius to replace the tibialis anticus. On the other hand no muscle transplanted from the peroneal or posterior tibial groups will be effective in replacing the loss of dorsiflexion.

In my experience the most consistent failure in tendon transplantation has been that of using the peroneus longus or brevis to replace a paralysed tibialis anticus. We did not realise that these were muscles normally in relaxation when the dorsiflexors of the foot are in action.

I have lately in several cases transplanted both the peroneus longus and brevis muscles for complete paralysis of the anterior tibial muscles in the hope that it may be possible to re-educate both to act apart from the posterior tibial muscles with which they are normally more closely associated in action. The present stage of the results of these do not yet warrant a definite opinion.

In the case of the posterior tibial and peroneal muscles, these are, in practice, one group. All are in action in extension of the ankle, so that they may be used to replace one another with success.

In cases of calcaneus deformity of the foot the success of transplantation of all posterior tibial and peroneal muscles to replace a paralysed tendo achilles is a striking illustration of the principle we have adopted.

In the case of the upper extremity, the individual action of the muscles is more highly specialized, so that re-education of a

muscle to functionate apart from the group with which it is normally in action is more practicable. Even here, however, we find success more certain if we depend on one of the same group for the transplantation.

This is well illustrated in the case of simple paralysis of the short extensors of the thumb. If we utilise portions of the radial extensors of the wrist to replace them—recovery of function is natural, abduction of the thumb being a movement closely and commonly associated with dorsiflexion of the wrist.

Without careful re-education transplantation of the flexor carpi radialis for this purpose is not so likely to be effective.

There is in this case a tendency for the other palmar flexor of the wrist, the flexor carpi ulnaris, to come into action with it, so that extension of the thumb is associated with ulnar deviation of the hand in a position of palmar flexion.

Where there is loss of power of flexion of one or more fingers, we must depend on other members of the same group for their replacement.

The flexors of the wrist should not be used for this purpose, as they are normally in relaxation when the flexors of the fingers are in action.

Paralysis of the intrinsic muscles of the hand results in loss of power of normal flexion of the proximal phalanges in closing the hand. Sir Harold Stiles has had success by transplantation of slips of the flexor profundus digitorum to the proximal phalanges in these cases. This also is an operation which meets the axioms we have annunciated.

I would ask the members of this Association to reflect on their experience of tendon transplantation, so that if we agree on this question of the selection of tendons—a further stimulus may be given to this important branch of Orthopaedic Surgery.

AN OPERATION FOR THE RELIEF OF CONGENITAL EQUINO-VARUS DEFORMITY

BY FRANK ROBERTS OBER, M. D., 231 MARLBORO ST., BOSTON, MASS.

A brief preliminary report of the operation to be described below was published in August 1915[1], and since that time sixty of these operations have been performed at the Boston Children's Hospital by several members of the staff.

The operation is based on the pathological anatomy of the structures chiefly concerned in holding the foot in a position of equino varus. It is not employed in children under two years of age as it is very difficult to remove the periosteal-ligamentous flap from the tibia and calcaneus owing to the fact that their bones are almost wholly cartilaginous in structure and consequently are easily injured in attempts to denude them of periosteum and ligaments.

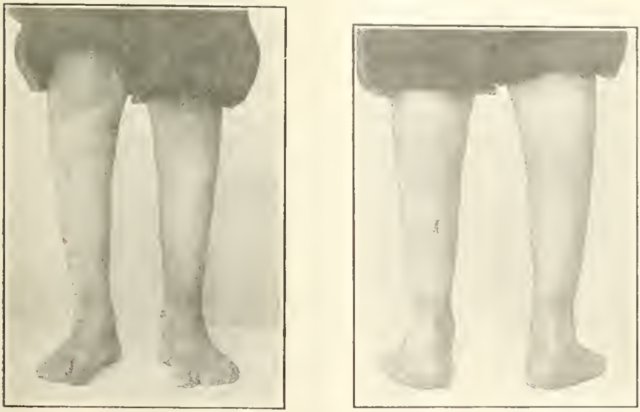
Pathological Anatomy

The pathology of a club foot begins at the knee and involves more or less the whole anatomy of the lower leg and foot. There is an outward torsion of the tibia, backward displacement of the external malleolus, shortening of all the tissues on the medial aspect of the foot and inner half of the plantar surface with a relative lengthening of all the structures on the lateral aspect, spreading of the fore foot, incurvation of metatarsal bones, adduction of the toes, and in those patients who have walked there are callosities and bursae in the region of the cuboid. The articular facets on the calcaneus and the astragalus are more or less altered depending upon the age of the patient and the severity of the condition.

Grossly, the deformity presents on inspection three distinct and separate elements viz: Plantar Flexion, Adduction and Inversion; these positions are maintained by contractures of tendons, ligaments and fascia in the dorsal, medial and plantar regions of the foot. In 1884[2], Parker and Shattuck published an article describing their post mortem observations on five cases of congenital equino varus in which they state that, after removal of all tendons the deformity still persisted and was not relieved until the deltoid ligament had been divided.

For clearness in description the pathology of each element will be taken up separately as follows:

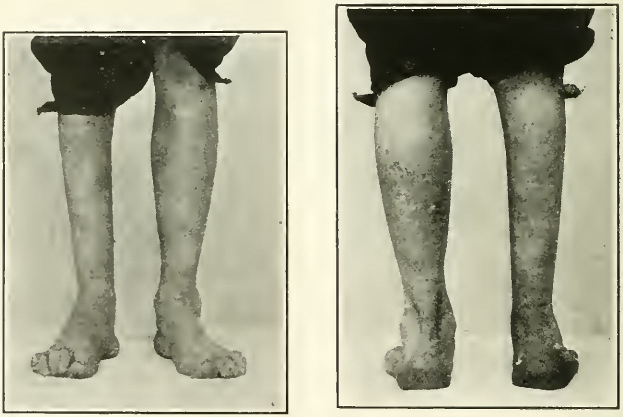
Plantar Flexion: The calcaneus is drawn up posteriorly and the astragalus is subluxed forward and often to such an extent that the posterior articular surface of the lower extremity of the tibia is in contact with the calcaneus. This position is maintained by contractures of the tendo Achilles and the posterior tarsal ligaments. As a result of a long continuance of this position it is difficult to force the astragalus back into the mortise formed by the



E. M.—Operation at eight years. Right foot operated March 15, 1915. Four previous operations, left foot having been corrected. February, 1920, thirteen years. Over corrects foot voluntarily, walks without a limp.

malleoli because the astragalus is shaped like a wedge both laterally and vertically, the thick portion being anterior to the mortise. Consequently the articular facets on the malleoli become adapted to the thin end of the wedge thus increasing the difficulty of overcoming equinus. From observations at the time of operating on some of the older children it has been found that the anterior tarsal ligament has adhered to the superior articular surface of the astragalus and unless freed this also becomes a factor of resistance to correction of the equinus.

Adduction: The scaphoid is subluxed inward and articulates with the medial aspect of the head of the astragalus and may in severe cases articulate with the anterior aspect of the internal malleolus. As a result of this position the head of the astragalus is deflected laterally and tends to become pointed or V shaped. The cuboid is also subluxed inward and articulates with the medial aspect of the anterior articular surface of the calcaneus. The anterior articular surface of the calcaneus also becomes pointed or V shaped.



J. M.—Operation at ten years. Right foot operated June 10, 1915. February, 1920, fifteen years. Voluntary dorsal flexion without adducting, has a few degrees of active motion in abduction and adduction, 20 degrees in flexion, walks toeing out without a limp.

The above alterations of normal articular facets offer considerable resistance to the correction of the adduction. The position of adduction is maintained by contractures of the anterior and posterior tibial tendons, the inner half of the plantar fascia, the longitudinal fibres of the deltoid, the inferior calcaneo-scaphoid and the astragalo-scaphoid ligaments.

Inversion: The calcaneus is subluxed or rotated inward beneath the astragalus on its long axis and carries the fore foot with it. It is slightly curved laterally and in the severe cases the sus-

tentaculum tali may articulate with the internal malleolus. This position of inward rotation is maintained by contractures of the tibial tendons and the vertical fibres of the deltoid ligament.

Phelps, in 1891[3] found after ten years of experience "that the os calcis was inwardly rotated and for this he devised a powerful osteoclast to correct the powerful ligamentous contracture as it could not be done by hand." This element of the club foot deformity often persists after forcible manipulations and tenotomies and is probably the first of all to recur. It is impossible to correct it in osteotomy of the calcaneus unless the sustentaculum tali has been severed from the body.

The Operation

A curved incision is made over the medial aspect of the ankle joint, beginning two inches above the malleolus and half way between the border of the tibia and the tendo Achilles, carried downward, curving forward below the internal malleolus and then upward ending over the internal cuneiform.

The incision includes the tissues down to the deep fascia. The flap thus formed is cleared from the lower end of the tibia. A second incision is next made beginning at the posterior tibial groove one-half to three-quarters of an inch above the internal malleolus extending forward across the medial surface of the tibia curving downward and ending at the inferior border of the scaphoid. This incision is made through the deep fascia, periosteum annular ligament and anterior portion of the deltoid ligament exposing the ankle joint. The deep fascia and periosteum are denuded from the bone and in the flap is included that portion of the deltoid ligament which is attached to the internal malleolus and the internal aspect of the astragalus. On retracting the flap the tip of the sustentaculum appears in the wound and from this is removed the ligaments and periosteum, the dissection being carried well down on the internal surface of the calcaneus so that the whole attachment of the ligaments is removed from it subperiosteally. In older children it will be found necessary to lengthen the posterior tibial tendon.

The next step is the subperiosteal removal of the astragalo navicular ligament from the scaphoid and clearing the superior

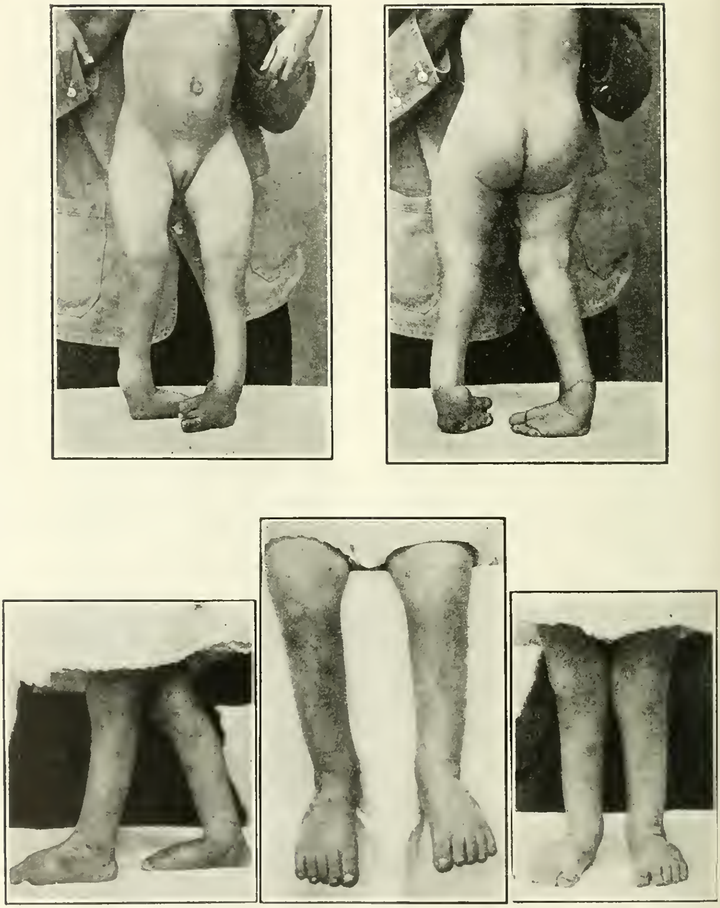


J. C.—Operation at four years. Left foot operated June 16, 1915. February, 1920, eight years, walks with both feet straight without a limp, arch low, voluntary dorsal flexion with the foot slightly abducted.

surface of the astragalus of the anterior tarsal ligament if it be adherent. The plantar fascia is divided subcutaneously. The adduction is over corrected by manipulation over a wedge and after this has been done forcible manipulation of the inversion and plantar flexion is performed until moderate over correction has been secured; the tendo Achilles is next divided subcutaneously and the manipulation continued until the foot can be held in a position of desired over correction of the whole deformity by one finger. The reason for leaving division of the tendo Achilles until the end is, that it seems to aid in the early part of the correction making it less difficult to drive the astragalus back into the mortise. The periosteal-ligamentous flap is sutured with one inter-

J. M. Operation both feet May 10, 1919. Recurrence after previous operation March 25, 1918. March 1920, arches flat each calcaneus everted, over corrects voluntarily, adduction of the phalanges.

rupted chromic catgut stitch to the anterior portion of the deltoid ligament in such a way as to leave a good margin of its tip in contact with the lower end of the malleolus. The subcutaneous fat and fascia are united by interrupted chromic catgut sutures. The skin is closed with No. 12 interrupted silk. This is used because other suture material will not stand the tension of approximation when the foot is held in an over corrected position.



T. D. Five years. Operation October 27, 1919 both feet, plaster worn until February 18, 1920. March 24, extreme over correction, both passive and active. Never had any previous treatment.

Post Operative Treatment

The foot is put up in plaster reaching from the toes to the mid thigh with the knee flexed and in a position of only slight over correction, because full over correction impedes the circulation to a serious degree. This is probably due to stretching and flattening of the posterior tibial vessels. Fourteen days after the operation the stitches are removed and the plaster changed but at this time the amount of over correction can be greatly increased without interfering with the blood supply. If the position be unsatisfactory the plaster may be renewed at monthly intervals until the desired amount of over correction is obtained.

The foot should be kept in plaster for four or five months and then some form of club foot brace should be worn night and day for six or eight months longer.

General Considerations

One of the chief characteristics of congenital equino varus, without regard to what method of treatment has been pursued, is an inherent tendency to recur and a relapse after removal of cuneiform wedges amounts almost to a surgical disaster. A few relapses have occurred after the operation described above has been performed but the foot can be over corrected again by the same method.

A club foot should never be considered as having too much over correction and any early desire to relax in after care will practically always result in a recurrence.

A cure is not complete until every element in the deformity is over corrected and the patient is able voluntarily to put his foot in a position of over correction.

Summary

1. The operation lengthens the foot.
2. Any desirable amount of over correction may be obtained.
3. No important vessels and nerves are injured.
4. The removal of the contractures allows one to obtain an anatomical reposition of displaced bones.

Reference:

1. Ober. Jour. A. M. A. Aug. 14, 1915.
2. Pathology and Etiology of Congenital Club Foot, Robert M. Parker and Samuel G. Shattuck, 1884.
3. Phelps, Reprint from the New Eng. Monthly, 1891.

SOME FACTS ON SCOLIOSIS

H. A. PINGREE, M. D., F. A. C. S., PORTLAND, MAINE

In the June number of this Journal under the caption "Special Article," with a title "The Surgical Treatment of Scoliosis" appear some statements which are apparently so misleading that the proper treatment of the deformity is obscured and a brief presentation of facts which their author has failed to recognize seems necessary. In order that some of the views held by the author of the above mentioned article may be noted without reference they are here quoted verbatim and answers made to them.

> "The thorax moves as a whole."
>
> "No vertebra or no rib moves singly."
>
> "The thorax moves as a whole and each component part has its own part to play during any movement of the thorax."

The thorax does not necessarily move as a whole since a small section of the spine with the attached ribs may be moved without affecting the remainder, or one section may move in a certain direction and the rest move in an opposite direction. It is only in severe cases of arthritis of the spine in which ankylosis of the joints is complete that the thorax must move as a whole. The spine —a flexible body—and its appendages are so constructed anatomically that sections of the thorax may move or be moved without materially affecting the rest. If this be not so, how can a pathological scoliosis exist in one section of the thorax and the rest remain in a normal position?

No better illustration of the movableness of one part of the thorax by applied force, can be shown than in the accompanying illustrations, which are used simply to prove not only that one vertebra can be moved upon another but that it can be moved easily and harmlessly. (Figs. 1 and 2.)

Fig. 1 is an exact tracing of the skiagraph in a mild case of pathological scoliosis before reduction of the deformity. Fig. 2 is a tracing of a skiagraph of the same spine immediately after the first plaster corset was applied.

Note the position of the eighth vertebra which has been partially dislocated by pressure on the wrong ribs. The force used

in this case was so little that the patient did not complain of any discomfort whatever; was up around playing with the other children immediately after the corset was finished; and [illegible] no pressure symptoms whatever.

In a normal spine it is possible even by very slight [illegible] to push one or several vertebrae out of normal relationship with the others.

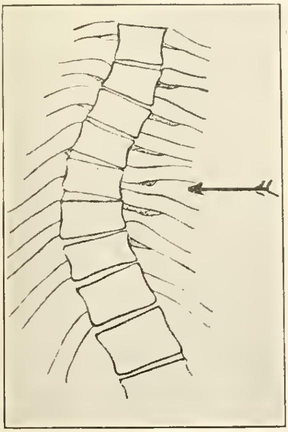


FIG. 1.

Skiagraph of a case of left scoliosis, before corset was applied.

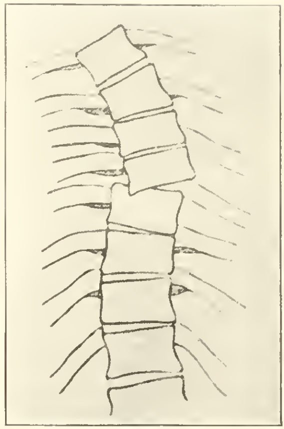


FIG. 2.

Skiagraph of same case as Fig. 1. Result of pressure wrongly applied. The pull was made against only two ribs instead of being distributed. This amount of displacement of the body of the eighth vertebra caused no symptoms whatever.

He also states that, "Physiological movements of the thorax are intricate." "Physiological scoliosis is a complex condition." "Pathological scoliosis is equally complex, * * * *." "For these reasons the correction of a pathological scoliosis is difficult."

The physiological movements of the thorax are not intricate when once understood, and physiological scoliosis is not a complex condition, but one of the normal physiological positions of the body

assumed at will frequently and necessarily many times daily during the ordinary activities of routine life.

It is simply the position of flexion plus lateral bending, plus rotation of the bodies of those vertebrae included in the curve towards the convexity of the lateral bend. It is the very frequent position assumed by the student, who sits obliquely at a desk writing.

Pathological scoliosis is no more complex than physiological scoliosis, since it is the same position.

On account of these two facts the reduction of a pathological scoliosis is not difficult unless the deformity is so extreme or affected by disease that like other deformities the parts cannot be brought completely to a normal position.

It is not the reduction that is difficult but the thorough understanding of the fundamental principles which make it possible and without which correction is absolutely impossible.

He further states that, "It was suggested some years ago that the rational treatment for pathological scoliosis was to produce a physiological scoliosis of a reverse character, but it has been rightly contended by the author of that method of treatment that vertebrae which have been pathologically changed, now being wedge-shaped, are carried individually and collectively into a new position by the production of this physiological scoliosis forming, indeed, an area of pathological scoliosis of a reverse character to the physiological scoliosis now produced." If this quotation be correctly interpreted by the writer of this article the author means that the original deformity is carried in toto, and unchanged to the other side of the median line.

It is true that the above suggestion was made by him some years ago, and he accompanied that suggestion by another which was, that, by pulling the spine to one side and twisting one end of it, a physiological scoliosis was created.

With the investigations which have been made in recent years in scoliosis and the light which has been thrown on the subject by them, certainly no one could entertain the latter suggestion, since the conception is so different from what is now known to be correct that it appears absurd.

The statement in the beginning of his first suggestion "that the rational treatment for pathological scoliosis was to produce

a physiological scoliosis of a reverse character" is correct. This is a fundamental principle which governs the correction of all similar deformities, a principle recognized so long ago that there seems to be no author, and he should not imply that he discovered it, and what is of still greater importance, he should not indicate that he even approached the discovery of that physiological scoliotic posture or a method of producing it. As already stated the posture which he produced in his attempt to establish this long known fundamental principle in the treatment of scoliosis and allied deformities had very little, if any, resemblance to the true physiological posture of scoliosis and therefore, the method of reduction advocated by him does not and cannot produce results. In such a procedure most certainly the thorax moves as a whole and the deformed vertebrae" are carried individually and collectively into a new position by this physiological scoliosis forming, indeed, an area of pathological scoliosis of a reverse character to the physiological scoliosis now produced." Nothing else could be expected from such an understanding of the position of physiological scoliosis. Simply bending the spine and twisting one end of it does not produce a scoliosis of any kind.

Certainly the statement that "we cannot cure the greater by the less" is well made since it is impossible to produce the physiological posture in this way let alone correcting the deformity. In other words, no one could cure any deformity of the spine in this way; in fact, one could scarcely partially correct it by following such principles.

Proof that vertebrae and ribs are reversed in their positions when carried into the opposed scoliotic posture in the reduction of the deformity is positive.

An illustration of this is shown in Figs. 3 and 4.

Fig. 3 shows tracings of a skiagraph in a pathological scoliosis, and the arrow points to a wedge-shaped vertebra.

Fig. 4 shows a tracing of a skiagraph of the same spine in over-correction, and the arrow here points to the same wedge-shaped vertebra in its reversed position.

The facts stated here relative to Figs. 1, 2, 3 and 4 are so easily proved that anyone having the inclination to search out the truth may readily possess the knowledge by his own work, if so minded.

It is true "that in certain methods of treatment forces which are applied to produce beneficial results in one place may produce the reverse in another,'" but it is equally true, if the proper method is used, that such does not occur, and it is failure to understand the correct fundamental principles in the reduction of the deformity that has caused so much adverse comment.

No one would want to deny, or attempt to do so, "that there are patients afflicted with scoliosis, of such a degree, that no form of treatment yet devised can be depended upon to relieve their de-

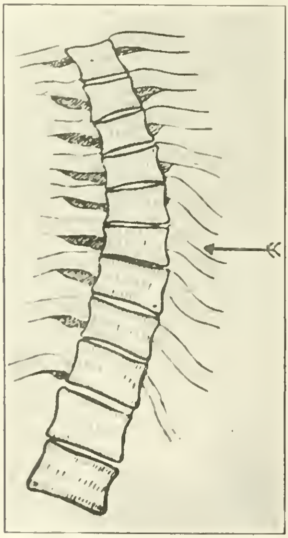


FIG. 3.

Skiagraph of a case of scoliosis, before corset was applied.

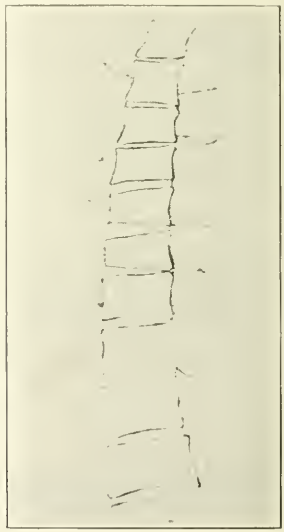


FIG. 4.

Skiagraph of same case as Fig. 3, after over-correction. Complete over-correction of both rotation and lateral bending. The deformity does not swing to the over-corrected position in toto, but each vertebra has reversed its original position held in the previous deformity.

formities." Any method has its limitations just the same as any method for the correction of other deformities has.

It is also true that in these cases i. e., those where the deformity is so great or affected by disease that complete reduction is impossible, we must content ourselves with doing what we can for them, but it might be said with equal truth that if the proper method of reduction was in general use instead of the many varieties of old methods, which are of little, if any value, there would be so few of the impossible ones that the operative end of the treatment would require little if any attention, except in cases of paralysis.

No exceptions are taken to the remarks made on the value of an operation in hopeless cases of the deformity, as unquestionably such a procedure is indicated, but in his final paragraph where he, the author, states "in conclusion the writer should say again that he does not believe that any method has been devised for the rapid and complete reduction of pathological scoliosis," it may be said in passing, that he apparently does not recognize pathological scoliosis except in its hopeless stages, or else he is in the same position as the general practitioner who has never seen any results from the use of antitoxine in diphtheria.

Editorial

The editor desires to call attention to the abstract in this number by Dr. Donnelly of an excellent recent article by Dr. Dean Lewis on "The Principles of Peripheral Nerve Surgery" (Journal A. M. A., July 10, 1920).

Since the publication of the important book by Tinel, careful articles on peripheral nerve injuries and their repair have been written by Platt, Cone, Adson, Danforth, and many others. Much excellent work was done by Sir Harold Stiles of Edinburg, and others in the British Isles. As a result, we have been able to arrive at a number of very definite conclusions in regard to the indications for operation in peripheral nerve injuries and their results.

In general, these are about as summarized by Dr. Lewis. First, neurolysis, or release of an injured nerve from scar, gives a high percentage of excellent results. Second, early, accurate re-suture of divided nerves gives a considerable percentage of return of power in the affected area. Third, the farther one gets from these simple procedures, the less one's chances are for improvement. That is to say, more highly technical operations like nerve transference, cable transplants or even tubulization of re-united nerves, give disappointing results as a rule.

Dr. Lewis has very comprehensively and successfully laid down as the title of his article suggests, the principles which must govern the selection of cases and the technical procedures to be employed in practically all peripheral nerve injuries and operations.

Any conclusions regarding peripheral nerve surgery, however, from Dr. Lewis' article, must be tempered by the fact that Dr. Lewis has made no mention of the points brought out by Dr. Murray S. Danforth in his article in this Journal last year, regarding the preparation of patients and their extremities for nerve operations.

It is of the greatest importance that existing deformities be corrected and that as nearly a normal range of motion as possible

be secured for entire affected extremities. This applies to the period both before and after any operations of this sort. These operations and the various associated tendon plastic procedures demand careful consideration of measures for the restoration of position and establishment of full range of motion. These are absolutely essential or the most skillful surgical procedures will be of no avail.

News Notes

The Interallied Conference on the care of the war crippled was held this year in Brussels September 19 to 24.

The fifth congress of the International Society of Surgery was held in Paris July 19-23. Dr. W. W. Keen presided. Dr. Depage was one of the prominent members. Sir William Macewen was elected president and the next meeting will be held in England in 1923. Arthroplasty is one of the subjects assigned for the next meeting.

Colonel F. F. Russell has resigned from the Medical Corps, U. S. Army. He will assume charge of the Division of Public Health Laboratories of the International Health Board of the Rockefeller Foundation.

Dr. Joseph Spellissy of Philadelphia and Mrs. Spellissy were seriously injured in an automobile accident on September 2. The car in which they were driving was struck by the Philadelphia-Long Branch Express. Mrs. Spellissy is dead. Dr. Spellissy is at the Ann May Memorial Hospital at Spring Lake Beach, with the result of his injuries still in doubt, at the time this note is written.

Dr. Spellissy has done much good work in the American Orthopedic Association.

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Current Orthopaedic Literature

Principles of Peripheral Nerve Surgery. By Dean Lewis, M. D. Chicago. *Jour. A. M. A.*, Vol. 75, No. 2, July 10, 1920.

When a nerve is divided, definite evidences of regeneration are noted within a few hours in the proximal segment adjacent to the point of injury. Some of these early changes are abortive, but others indicate attempts at repair. Some degenerative changes occur in the neuraxes in the distal end of the proximal segment. These do not extend far back in the nerve, probably only to the next node of Ranvier.

Definite regeneration of neuraxes occurs only in the proximal segment, and all the neuraxes that eventually neurotize the distal segment passing into the motor end plates and sensory endings develop from these of the proximal segment. By the eighth day after division of a nerve, the medullated fibers of the proximal segment have given off numerous lateral rami, some 5 mm. above the point of section. These grow distad beneath the old neurillemmal sheath. The non-medullated fibers also dissociate into bundles of neurofibrillae which grow down in the old sheath by the fourteenth day. In studying the repair of nerves thru a gap, it can be positively demonstrated that no neurofibrillae can be found in the distal segment until those developing from the proximal segment have bridged the gap.

The changes that occur in distal segment after division are equally important to those occurring in the proximal. Nerve impulses cannot be transmitted without neuraxes, but the neuraxes cannot reach their terminal distribution unless bands of conduits are formed along which these can pass or creep, both degenerative and regenerative changes occur in the distal segment after division. The neuraxes soon become broken up. Often they seem to have snapped. Later they break up into fine granules. The myelin breaks up into balls and globules. While these degenerative changes are occurring, in the neuraxes and myelin sheaths, definite evidences of growth or repair are noted in the sheath cells. The adult neurilemmal sheath (Schwann) is a fine, thin, structureless membrane provided with fusiform nuclei—one to each node of Ranvier, the latter varying from 80 to 900 microns in length.

After division, the sheath cells of both the proximal and distal segments bordering on the traumatized area react early. The first indication of a growth change is indicated by a slight increase in the granular cytoplasm surrounding the nuclei of the sheath cells. This change is observed within 24 to 36 hours after division in the cells immediately adjacent to the zone of injury. The cytoplasm increases rapidly in amount, the nuclei undergo mitosis and by the fourth to the sixth day definite protoplasmic bands have formed. These are narrow strands or bands of protoplasm with hyperchromatic nuclei. This growth change, leading to the formation of protoplasmic bands, occurs throughout the distal segment. Certain factors, probably traumatic, greatly accelerate the process in those sheaths bordering on the line of division. The fully formed

protoplasmic bands appear later in the peripheral parts of the distal segment than in those adjacent to the line of division.

These evidently play an important role in nerve regeneration; for the fibers which have no neurilemmal sheaths, such as those of the optic nerve and spinal cord, do not regenerate after division. Kirk and Lewis, in studying regeneration of peripheral nerves after fascial tubulization, could demonstrate these bands passing through and bridging the gap. They seemed to precede the developing neuraxes forming a pathway for these as they developed. The neuraxes—the conducting portion of the nerve fiber—develop only from the proximal segment after division of a nerve. The changes in the neurilemmal sheath which occur throughout the distal segment and in the distal part of the proximal segment adjacent to the line of division—the so-called wallerian degeneration—are essential to the definitive regeneration of the nerve.

In the repair of a divided nerve, the first consideration is to provide easy access for the developing neuraxes to the distal segment. After division of a nerve, a neuroma will develop within nineteen days. Even when there has been no hemorrhage or infection, a neuroma develops. The cut fibers retract within the epineural sheath and a connective tissue cap forms over the end of the nerve. There is a very marked attempt at repair, for the developing neuraxes, as they reach the connective tissue, formed by the cells of the endoneurium and perineurim and surrounding tissues, turn back on themselves to form the spirals described by Perroncito. The neuromas which invariably form after division of a nerve are indicative of an attempt at repair which has been thwarted by scar tissue. Some of the developing neuraxes may zigzag through scar tissue and reach the distal segment, but it is doubtful whether they will reach the terminal connections to which they were originally destined.

Scar tissue forming after division of a nerve interferes seriously with nerve repair. There has been a tendency of late to advise suture by neuroma. There will be few successes when such a procedure is attempted. In all cases the neuroma should be resected until healthy funiculi appear and to the point where scar tissue is not visible to the naked eye. In many instances even after the neuroma has been resected far back, the funiculi will have a peculiar matted, gelatinous appearance. This appearance is due to small amounts of young connective tissue, developing neuraxes and some edema. The results which have been obtained after suture would seem to indicate that successful nerve repair may be obtained when end-to-end suture is made between funiculi having this appearance.

It is advisable in many cases to employ frozen sections to determine the level to which the resection of the neuroma should be carried.

Success in peripheral nerve repair depends on accurate anatomic approximation of the two ends. The importance of the internal topography of the peripheral nerves should be emphasized. Stoffel has insisted that the funiculi in a mixed nerve have a fairly definite position and that the sensory and motor funiculi, which serve different muscles, maintain their position and relation throughout the entire course of the nerve, for Langley has demonstrated in peripheral nerves an internal plexus. The internal plexuses apparently serve to collect together the afferent and efferent fibers of the different nerve roots for the areas supplied by the peripheral nerves, just as the brachial and lum-

bosacral plexuses do for the large areas supplied by the nerve trunks. In the region between the origin of two successive nerves, not arising close together, the bundles are arranged in groups which have little or no connection with one another although the bundles forming the group are more or less interconnected. Such a region is called an intermediate region, but gradually blends with the region in which is found the plexus which is formed by the interlacing of fibers or bundles given off from the nerves or bundles of the intermediate zone. Langley's work agrees with that of Dustin, who described an interlacing of nerves or bundles between the funiculi or peripheral nerves at points where branches are given off.

As far as the surgery of peripheral nerves is concerned, Stoffel's and Langley's work, although differing in detail, emphasizes the importance of nonaxial rotation of nerve trunks during suture, thus avoiding distortion of the nerve pattern.

The funicular suture is the object to be desired, but the author believes it impossible. As perfect anatomic repair as is possible should be secured in order to preserve the nerve pattern. The surgeon who makes the most perfect anatomic repair will, other things being equal, have the greatest number of successes.

It is often difficult to determine whether or not rotation has occurred or the amount of rotation, if such has occurred. This is especially true when the nerve has been divided by a missile, for the nerve after division may be rotated by the force continuing to act. When the nerve is exposed, fine silk sutures may be inserted on both sides of the nerve before it is lifted from its bed. These serve as guides to determine the exact position of the nerve segment when suture is attempted. Mosquito forceps may be used for the same purpose, but they are not so easy to handle and may cause more injury to the nerve.

If after suture, fibers originally destined for a certain group of muscles become partly distributed to their own group and partly to another group, marked inco-ordination of movements may occur. The movements are then no longer precise. They are awkward and without force. This is often seen after suture of the radial nerve, when the supinator longus contracts more forcibly when attempts are made to use the extensors of the wrist than when the forearm is flexed on the arm.

The length of time intervening between the division of the nerve and repair is the third important factor in determining the success of nerve suture. Those cases in which nerve suture is performed early, in which the period between the injury and the operation does not exceed three or three and one-half months, have a higher percentage of recoveries than those in which the suture is performed later. The importance of the time element cannot be emphasized too strongly, for there is a tendency in civil practice to delay operation in hopes that improvement may occur if massage, electricity, etc., are continued long and faithfully. Supplementary movements; movements which are not dependent on regeneration of the injured nerve are often regarded as evidences of recovery. These movements should be carefully studied, for operative interference should not be delayed because of the mistake of interpret-

ing these movements as evidence of return of function in the paralyzed group of muscles.

End-to-end suture is the only procedure that can be relied upon to re-establish the continuity and function of a nerve after division. It makes no difference concerning the suture material, for fine silk or catgut gives equally favorable results. Transfixion sutures do not seem to disturb the nerve pattern, but epineural sutures are most satisfactory. In cases where some traction must be exerted, it may be necessary to employ one or more transfixion sutures.

The sutures should be applied so that the epineurium is closed, thus preventing straying of neurofibrillae into surrounding tissues. The ends should be approximated without pressure. It has been advised that a small gap be left. The author believes this poor advice, although one can see the reason for it after examining neuromas which have been removed when the s.ture was performed.

Mobilization of the segments will often permit of end-to-end approximation even when the defect is long, especially when combined with displacement of the nerves and change in the position of the parts. Dissection of a nerve from its bed apparently does not interfere with regeneration, for recovery within the time expected after suture occurs when, for example, the sciatic is dissected out of its bed for considerable distance. In the cases in which the defect is so long that end-to-end suture is impossible, many procedures have been suggested. Cable Transplants:—Experimentally, auto and homo-cable transplants will conduct neuraxes from the proximal to the distal segments. Fascial tubes can also be used with success experimentally.

The results obtained by Platt in clinical surgery when these procedures are employed are not encouraging. These suggest either that the results obtained experimentally cannot be applied directly to clinical surgery or that our technic is at fault in this work.

Platt's conclusions are as follows:

1. In 18 operations in which fascial tubulization combined with autogenous nerve grafts, fascial tubulization alone and autogenous vein tubulization (one case) were used, there was a complete absence of any clinical sign of recovery. The shortest period over which observations were made was four months, the longest period 26 months.

2. Secondary explorations in 4 cases showed complete silence of the nerve trunk to direct faradic stimulation. End-to-end suture was accomplished in all exsections of the bridged segment.

3. At the re-exploration operations, partial or complete obliteration of the lumen of the fascial tube was noted.

4. In two specimens examined histologically, a tubulization alone, showed obliteration of the lumen of the tube by fibrous tissue in which no nerve fibers could be found. In the second, a graft and tubulization combined, nerve fibers were present in the center of the obliterated tube 18 months after the operation. There was no sign of continuity between the proximal and distal ends through this strand of nerve fibers.

5. The early re-exploration of all graft and fascial bridge operations is advisable.

In 120 operations auto cable transplants were used 12 times and tubulization with fascia 6 times. In none of these has there been recovery, although in two transplantations there has been some slight return of motor power in isolated muscles. The striking thing is that the transplant may increase markedly in size. The author believes that these cases should be explored after a reasonable time as a block to the developing neuraxes may occur at the junction of the transplant and the distal segment. Resection and suture at this point might favor the downgrowth of neuraxes and neurotization of the distal segment.

The group of nerve injuries in which there is no anatomic division but a physiologic interruption of nerve impulse offers some interesting problems. The pathology varies considerably. Constricting bands, thickened epineurium, bony callus and thickened cicatricial nodules within the nerve resulting from intraneural hemorrhage and proliferation of intraneural connective tissues are the conditions most frequently found.

Not all are agreed as to the procedure to be followed. In some cases the indications are well defined. Tinel has stated that neurolysis is permissible only when it restores a free, supple nerve, in the interior is found no obstacle to regeneration and that as a whole liberation is ineffective in cases of severe lesion of nerve trunks associated with rupture of the sheath, and development of scar tissue with the formation of the neuroma. In these cases the cicatrical tissue is either permeable to regenerating axis cylinders, in which case intervention is useless, or the obstacle does not permit of the passage of axis cylinders, and an operation such as neurolysis will not make it permeable. Neurolysis is of distinct value, but it is sometimes difficult to determine whether or not the results are the direct results of surgical intervention. Many of the patients recover spontaneously. The value cf the operation cannot be denied in those cases in which paralysis has existed for months and in which a distinct return of motor power occurs within 10 days following the operation. Nerves which present the least macroscopic change may have the greatest alteration in or suspension of function. This is especially observed in those cases in which a number of nerves, some of which have recovered spontaneously, have been affected. When the operation is performed it may be found that the nerves presenting the most marked pathologic changes are the ones that have recovered spontaneously.

Whether neurolysis or resection is to be performed depends upon the appearance and feel of the nerve and the electrical reaction. The time element is important in determining the results after neurolysis, that is, the time existing between the injury and the operation. There is no relation between the amount of improvement and the time at which it begins after this operation, for many of the patients who improve the most are those who begin to improve some time after operation.

A number of methods have been suggested to prevent the reformation cf scar tissue after neurolysis. Whenever possible the liberated nerves should be placed between uninjured muscles. Even in large wounds with a great deal of scar tissue it is possible to displace muscles so that a new bed can be formed

for the liberated nerve. Liberated nerves should not be placed in contact with cut muscle fibers, for the adhesions which then form may seriously interfere with the conduction of the nerve impulses.

Cargile membrane is the next choice. Fascia cannot be used for this purpose to advantage. When placed in contact with scar tissue it becomes invaded by and converted into scar tissue. The author has reoperated upon three cases in which a free fat transplant had been used for neurolysis. The fat had disappeared from all, and in the place of the transplant were adhesions. These were delicate, but delicate adhesions frequently seriously interfere with nerve conduction.

Peripheral nerves have great regenerative power. The procedures that are necessary to the establishment of repair are plainly indicated by clinical and experimental studies and the histologic examination of specimens. Changes occurring in muscles and joints which develop during repair unless prevented or corrected will defeat the purpose of the operation. Careful and assiduous after-treatment is necessary. There should be the closest co-operation between the physiotherapist and the surgeon. Nerve injuries occurring in civil practice should be operated upon earlier than they are. Time is lost waiting for evidence of return of function. Secondary changes occurring in the nerve during this time may render the operation difficult, often unsatisfactory and the changes which occur in the muscles and joints may increase and prolong the disability.

Early exploration after nerve injuries with loss of function of the muscles supplied by the nerve affected is advisable, for the condition of the nerve can be determined and steps taken to promote an early return of function. Results in nerve surgery become progressively worse with delay.—*Leo C. Donnelly, Detroit.*

A Case of Membranous Syndactyly Associated with Brachydactyly. E. Kirmisson. *Revue d'Orthopedie*, April 1919.

Report of a case of membranous syndactyly between second and third and fourth and fifth fingers of the left hand. The peculiar feature was the accompanying smallness of the fingers which were up to 10 mm behind the corresponding fingers of the other hand.—*A. Steindler, Iowa City, Ia.*

Abnormal Type of Syndactyly. Nove-Josserand, *Revue d'Orthopedie*, April, 1919.

Description of a case of apparently complete fusion of third and fourth fingers, with single nail. The X-ray reveals that true skeletal fusion is present only in the end phalanges, middle and basal phalanges being entirely distinct. This type represents an intermediate stage between true fusion (Giant finger) and Acro-syndactyly.—*A. Steindler, Iowa City, Iowa.*

ECTROMELIA OF THE RIGHT UPPER EXTREMITY. A. Mouchet and R. Pilatte. *Revue d'Orthopedie*, March, 1920.

Case observed was that of a nineteen year old girl presenting the deformity of Ectromelia on the right upper extremity. Most of the paper is given over to a minute description of the deformity the details of which must be seen in the original article. The main anatomical features of the case are the absence of the elbow joint and the very incomplete scapulo-humeral articulation; the malformation of humerus and absence of ulna; the only bone of the forearm was the radius.—*A. Steindler, Iowa City, Iowa.*

SUPERNUMERARY AND BIFID THUMBS. A. Mouchet and F. Lumiere, *Revue d'Orthopedie*, March, 1920.

Two observations. In the first case a bifurcation within the end phalanx with duplication of the nail; in the other case, there was, on the left hand, a bifurcation of the thumb over the metacarpo-phalangeal joint, with cutaneous syndactyly, the web reaching to the base of the end phalanx with both nails completely separated; the other hand showed an appendiceal thumb branching off over the head of the metatarsal, both phalanges being fully developed, but smaller.

The author calls the deformity in the second case: polydactylie policienne. —*A. Steindler, Iowa City, Iowa.*

THE MECHANICAL TREATMENT OF COMPOUND FRACTURES OF THE UPPER EXTREMITY. James E. M. Thomson, A. B., M. D., Lincoln. *Nebr. State Med. Journal*, June, 1920.

The paper is limited to the mechanical treatment of compound fractures of the upper extremity with no reference to etiology, anatomical relations, or infectious processes complicating bone injuries except as they bear directly on the treatment of the particular fracture discussed.

According to definite principles of treatment he has the following classification:—

I Fractures of the humerus.
- 1. (a) Fractures into the shoulder joint.
  - (b) Fractures of the Surgical neck and upper third.
- 2. (a) Fractures of the middle and lower third.
  - (b) Fractures into the elbow joint.

II Fractures involving the bones of the forearm.
- (a) Fractures above the lower fourth of radius and ulna, one or both bones.
- (b) Fractures of lower end of one or both bones and into the wrist joint.

In discussing the mechanical treatment he takes up the importance of first aid treatment as soon as possible after the injury. By this the proper splinting and position of the part is maintained during transportation and until hospital management can be begun. First aid plays a definite part in the ease of after management and the character of the final result obtained.

The various positions are described according to the site of the fracture, it also being emphasized that merely fixation and no traction be made in fractures of the shoulder joint, while traction is employed in fractures of shaft of humerus. In case of fracture of the elbow joint flexion with slight or no extension is the position of election.

The cock-up or dorsiflexion position should be maintained in case of fracture of the lower ends of the radius or ulna when there is carpal complication. Hospital management should embody every feature to promote the best results. The various mechanical devices should be largely guided and checksd by roentgen examination, in order to shorten the period of disability and at the same time hasten healing and union. The ambulatory type of splint should be used as early as possible. This is judged by the physical condition of the patient and the appearance of the wound.

In caring for these cases only sufficient traction need be employed to maintain position. In fractures of the arm, abduction angle and external rotation need be guided by the position of the upper fragment.

Shoulder joint injuries should not have traction. In fractures of the elbow, flexion is preferable when possible. Forearm fractures must be held in supination. The methods of making traction, the position of election, also the splints best adapted for the various types of fracture are very ably discussed. —*Sidney O. Reese, Lincoln.*

Treatment of Birth Fractures at Fordham Hospital. S. W. Boorstein, M. D. *Amer. Jour. of Dis. of Children*, May 1920.

The author discusses the various methods of treatment of birth fractures, vertical suspension, vertical suspension plus weight and pulley traction, modified Bradford frame with vertical suspension, oblique suspension combined with traction, and Truesdell's box splint.

He reports six cases, three of which had a fractured femur, two a fractured humerus, and the remaining case a fracture of a femur and a humerus. In these cases the Thomas knee splint with torsion traction was used. The perineal ring is not applied as tightly as in adults. The brace extends three or four inches beyond the foot. The ring is covered with flannel or chamois which can be changed every two or three days if necessary. To prevent foot drop a tongue depressor is placed on the plantar surface of the foot and held by bandage to the bars of the splint.

A roentgenogram can easily be taken and it is also easy to administer massage. The child lifts up the foot together with the brace, and thus the proper voluntary movements are made and union is hastened.

The patient can be cleaned and dressed easily and carried about whenever necessary. The braces are left on for from three to five weeks. The foot or hand has to be watched for swelling which can be prevented if the bands

are loosened up once in a while and the parts massaged. The ring of the brace must not be too wide, as it will press on the axillary vessels in the upper extremity or on the other thigh if the case is one involving the lower extremity. In the latter case a deformity may be produced.

In the author's experience with this method of treatment, both in the hospital and dispensary, the children thus far have all done well.—*Mark Cohn, M. D.*

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OPERATIVE TREATMENT OF OLD HIP DISEASE

BY DR. MARK H. ROGERS AND DR. CHAS. W. PEABODY, BOSTON

At the Orthopedic Clinic of the Massachusetts General Hospital, on account of the fact that we have mostly adult cases, and because we take cases over 14 years of age which have been under treatment at the Children's Hospital, we have had a chance to treat certain cases of old hip-disease which still require further treatment on account of recurrences, persistence of symptoms and disability. In this paper we shall discuss the indications for operative treatment, the types of operations, and the results obtained.

Perhaps the type of case under discussion can be illustrated by the following case. A girl of 18 years had hip-disease at the age of 6 years and was under treatment for 4 years. For the last 6 years she has had a recurrence of symptoms, pain and disability, practically every year so that she would be required to stay in bed for two months, generally during the winter months. She called these attacks recurrence of the hip trouble and rest in bed and fixation would always relieve the symptoms. On examination she showed a deformity of 50 degrees flexion and 20 degrees abduction, with one inch actual shortening and a slight amount of motion in the hip-joint. During her younger years a month or two in bed was not considered such a hardship, but now it interferes with her earning capacity and the problem is to give her a stable hip.

We have tried to standardize the kind of treatment to be used in the different types of cases and we find that these cases practically fall into three groups.

The first group consists of those with practically an ankylosis, fibrous or bony, but firm, with deformity of the hip-joint, flexion

and abduction, and shortening. The second group consists of those cases with deformity and with definite motion in the hip joint. The motion may be very slight, and may be difficult to obtain on account of muscular spasm but when these cases are under ether, there is always more motion than suspected. The third group consists of those cases in which the head of the femur is destroyed and the trochanter rides up on the acetabulum. This is the more rare condition and a difficult one with which to deal. There is practically always motion as well as deformity, and great disability on account of instability.

The first group, those with ankylosis and deformity may be passed over with few words because the treatment of this group is practically standardized. These patients seek relief on account of the deformity and the pain and discomfort that arises from the strain due to the deformity. We feel that it is practically settled that some form of osteotomy near the trochanter and outside of the joint for the correction of the deformity gives good results, and this group will not be discussed further.

The second group, those cases which show deformity and motion, with a portion of the head left in the acetabulum, is the type with which we are chiefly concerned in this paper. In looking over our records we find that this condition occurs about as frequently as the first group, and that ankylosis is not necessarily the end-result of tuberculosis of the hip.

In analysing our cases, it is motion, the few degrees that are left, together with deformity that causes strain and tension on this motion, that is the chief cause of the so-called recurrence of symptoms. For this reason it is not wise to do an osteotomy and correct the deformity, because the deformity is too apt to recur, without there being solid ankylosis, and because it does not prevent the return of pain and muscular spasm. It is practically a rule not to do an osteotomy when there is motion.

The best result of tuberculosis of any joint is ankylosis in the position of choice for that joint and that position in the hip is 20-30 degrees flexion and 10 degrees abduction. It is true of the knee-joint and other joints, and probably this is the reason why fixation treatment and the use of plaster spicas is more used now than traction splints, because it tends to early ankylosis. We would much rather see a case with firm ankylosis than with a few degrees of motion, because there is less chance of so-called recurrence.

If there is evidence of motion in the hip-joint and deformity, the operative treatment consists of correcting this deformity within the hip-joint and at the same time making the hip solid, by doing an arthrodesis. The incision should be such that the joint is thoroughly exposed, and for this purpose we use the Smith-Petersen incision. An incision is made from the anterior superior spine down the thigh. The space between the tensor vagina femoris and the sartorius is located. This is the anterior approach to the hip-joint. Then the incision is carried along the crest of the ilium for three inches and all the muscles are separated from the ilium subperiosteally. This brings you directly over the acetabulum and the head of the femur and allows a complete view of the hip-joint. This is the incision we are using routinely. The hip joint is opened from the acetabulum down to the neck and the capsule pushed back from the head. Then enough of the head is removed to allow for the correction of the abduction and for the flexion deformity to be fully corrected. The acetabulum is cleaned out so that the head will fit securely into the acetabulum and two bony surfaces are in apposition.

We feel that a great deal of care should be used to remove enough bone from the head and from the acetabulum so that the hip is absolutely firm in its new position and that bony surfaces are in direct contact and that no large gap is left to be filled in by fibrous tissue. This type of operation is analogous to an excision of the knee where it is very necessary to have absolute apposition. In the hip it is very much easier to obtain good apposition and to hold it, because while the hip joint is thoroughly exposed, the limb can be brought into abduction and it can be seen whether the contact is perfect.

If necrotic material or even purulent material is found at operation, this is cleaned out, but no attempt is made to remove every bit of pathological material. It is impossible to remove all tubercular material and it is no more necessary than in excision of the knee, because the cure of the disease lies in obtaining an ankylosis. The wound is sewed up carefully, practically always without drainage.

The third group, consisting of those cases in which the head is absorbed and the trochanter rides up on the ilium, present an entirely different problem and is a much more difficult problem to meet. We see comparatively few of this group, at least where

there is absolutely no head and where the trochanter is extremely high. In certain cases it is not possible to say absolutely whether a case belongs to the second or third group, because sometimes there is only a little of the head left and the trochanter lies very close to the acetabulum. In these cases the operative technique is really a combination of the method just described and the method to be described for the third group.

In two of these cases where the trochanter rode high on the ilium, it was thought that the probably cause of pain was the impinging of the trochanter on the ilium. For this reason we removed the top of the trochanter, an extra-articular operation, taking away the impinging surface, but leaving the hip mobile, without making any difference in the symptoms. So we feel that this is not a very probable cause of the symptoms, but that the instability of the joint and motion that is always present in these cases is the real cause of the symptoms. As we study all these cases it becomes more evident that the motion in the joint is the real cause of the continuance of symptoms.

The principle of the operative treatment of this third group is to place the top of the trochanter into the acetabulum and try to make as stable a joint as possible. This can best be done by the same incision, for it is absolutely necessary to have a complete view of the acetabulum. The acetabulum is thoroughly cleaned out and it will be found to contain a good deal of detritus and fibrous material. Then the top of the trochanter is cut off, a sufficient amount being removed to get down to bone and also enough to enable you to place the trochanter into the acetabulum as the leg is brought into abduction. It must be very carefully fitted and must be solid or else there is a tendency for it to slip out, as happened in one of our cases, requiring a second operation. This makes a fairly stable joint with the limb in abduction.

Now as to our bad results, because by studying these cases the value of any operation or its faults can be ascertained by such a study. One case, a girl of 18, had multiple sinus tracks dissected out about 4 years ago and two years ago an arthrodesis was done on account of continued pain and disability. This is the only case out of a series of ten in which the sinuses redeveloped. She is now in the same condition as before, two discharging sinuses, slight motion in the hip joint and pain and disability. We believe that the mistake was made, not in operating, because

the patient was extremely handicapped, but because the operation of arthrodesis was not thorough enough. The head of the femur was not firm enough to expect that a firm union could be established and it would have been better to have placed the trochanter into the acetabulum. In this way we probably could have obtained a much more firm and stable joint, and this case will probably have to be re-operated.

A second case will probably have to have a second operation, because there is still motion in the joint and this motion is painful. It is quite evident that whenever the motion is entirely lost the symptoms disappear and we believe that this second case was not done thoroughly enough. We have noted that in two of the cases the fixation of the joint was delayed for over a year, but ultimately the results were good in that the patient could bear weight without pain and was able to walk.

The results of the second group of ten cases, arthrodesis of the hip joint, are two poor, two delayed union and six good. By a good result we mean that the patient is able to walk without pain and without evidence of recurrence of symptoms and that the hip-joint is solid, in a fairly good position and that the patient is satisfied with the result.

In conclusions the following points should be emphasized:

The best result in such a destructive process as tuberculosis is firm ankylosis, and in order to prevent the recurrence of symptoms in adult life, this should be the aim of treatment.

The correction of deformity by means of osteotomy below the joint should not be done in cases where there is an unstable joint on account of recurrence of the deformity and on account of continued symptoms.

When there is motion in the joint, which is evidently the cause of symptoms, the deformity should be corrected within the hip joint and arthrodesis performed for stability of the joint.

Discussion

Dr. Truslow: As I take it, the object of this paper is discussion of that extremely trying condition, recurrence of tubercular hip joint disease. It recurs over and over again. These are very difficult cases. Personally, I feel that in the third group, where there is large destruction of tissue, and the bone which is left is high up on the ilium, the procedure outlined seems to be the one to undertake. I wish the speaker had said more of the first group,—ankylosis with a number of degrees of deformity. In the second series, a degree of

motion with flexion deformity, it has been my custom to give a long term of fixation with a plaster spica and attempt to correct the deformity a little more, as I believe one can, getting it toward the first position, that is ankylosis, and then decide whether one can get back mobility. I believe that in selected cases one can get back some motion. I don't agree that ankylosis is an end result to look for. I have got excellent results in two cases in which by the history and X-Ray plates the diseases was evidently stopped. I freed the head from the acetabulum, then took a sufficient amount of fascia lata, covering over the head with purse string suturing and thus getting a remarkable degree of motion. I must speak against considering bony ankylosis as a desirable end.

Dr. Osgood: I believe that Dr. Truslow may be right when he says that we must look for motion in the diseased hip. We think of tuberculosis as a disease in which we may well consider the classical lines of treatment as established but perhaps we shall still get back to the idea of some voluntary motion in the hip joint, without weight bearing as favorable to the cure of the disease. We are now learning how much the lymph and blood supply to joints is favored by voluntary motion. The amount of eventual motion, if any, will be small where the disease is of long duration and it usually means a constantly painful hip. With the changed and partially destroyed weightbearing surfaces, to hope for useful motion is more or less like the purification of politics, an iridescent dream. Dr. Truslow spoke of the disease being over: I have never yet met anyone who could tell me when tuberculosis was over. I have operated on an elbow joint and gotten a good immediate result from the arthroplasty. Later the patient developed tuberculosis in the elbow joint. The patient had had tuberculosis of the elbow as a child, twenty-eight years before, but the history was not accurately obtained and it had been unsuspected. We must not forget Dr. Painter's paper on the malignancy of bone and joint tuberculosis. Patients should never be told that the danger from the disease is entirely over. I think Dr. Rogers' study is extremely instructive. The Smith-Peters incision is a lasting contribution to surgery of the hip-joint, but one is not obliged to employ it in all hip-joint operations. It is of advantage where you need a large exposure especially of the acetabulum.

Dr. Freiberg: I feel that I would rather have a mobile hip joint for my own case, if I could control the motion. The X-Ray shows us why the mobile joint was not feasible. The muscular apparatus has been damaged during the years when the hip was a useless proposition and this interferes with placing the hip in the proper position. Operation by the Smith-Peters incision is admirable but it is a considerable operation. Abduction is not obtained unless there is a tenotomy of the adductors to make abduction possible. One could get a more satisfactory position of abduction in this way.

Dr. Brackett: "One of the important features to be decided in this operation is the angle of ankylosis to be given to the patient. In my opinion, as a rule, we give too little flexion and too much abduction, forgetting that patients are obliged to both walk and sit, and a compromise position between the best walking and the best sitting position gives the ideal angle. To condemn a person who has a sitting occupation with an ankylosed hip to the position of nearly full extension is unfortunate. On the other hand, it is easy for an individual to walk with a very considerable degree of flexion; in fact, a considerable degree of flexion gives an easier gait than a position of full extension. The position of equinus of the foot used in walking, overcomes the added shortening from the flexion and also gives an elasticity of the gait; at the same time it allows the patient to sit in a much more comfortable position, and to go into public places with much greater ease than with the leg which is constantly projecting forward and in the way.

The rule of giving abduction which applies to children does not have the same force, when applied to adults. It is always to be expected that a decided amount of abduction disappears in the growing period of children, and, there-

fore, the abduction obtained by the operation does not, as a rule, entirely persist. On the other hand, abduction in an adult with a less flexible spine, throws the base of weight bearing so far laterally from the line of gravity that the gait is both awkward and difficult. The small amount of lengthening obtained by this does not compensate for the difficulty and awkwardness of gait.

Dr. Soutter: In a subtrochanteric osteotomy for the correction of hip deformity it is very hard to overcome all of the flexion. If all of the flexion is to be overcome the post-operative position should be that of hyperextension. It is also difficult to get good abduction. If the ultimate position is to be a straight hip—that is to say, a neutral position as to abduction and adduction, the hip should be abducted about twenty degrees. In other words the abduction should always be from 15 to 20 degrees more at the time of operation than what the surgeon wishes the ultimate abduction to be.

As the case progresses, flexion and adduction are always increased and are usually more than we wish. The best ultimate position in the average case is 25 degrees of abduction and about 10 to 15 degrees of flexion. This gives the necessary length. When the hip is not entirely stiff but the motion is limited, this position will be the most satisfactory one in every way. In a woman with very large hips an ultimate position of about 15 degrees of abduction is sufficient and a pad is worn over the hip to make the clothes look symmetrical.

Dr. Ryerson: It seems to me that this is a very important subject and there are several points that we ought to settle. I have realized that the old teaching of the masters that abduction is desirable is not the best teaching. It is good for children, but as they get older they complain of the abducted position. The point of giving more flexion is also important. The other point is that we should not do arthroplasty in old tubercular hips. It is flying in the face of Providence. I took three or four cases who had shown no evidences of activity for years, and did arthroplasties, and they developed dangerous tuberculosis in the hip joint. I found caseous masses which had persisted for ten years without symptoms. No man can say when the tubercle bacilli disappear. Don't let us advocate making mobile hips out of old tuberculous joints. The sooner we make these joints stiff and leave them stiff, the better.

Dr. L. T. Brown: I would like to add my word to that of Dr. Brackett. A recent patient with a tubercular spine, who had had a bone graft, also had an arthrodesis of the hip. The hip was in a position of 50° flexion and some 5° adduction. The patient said he preferred this position of adduction, and for his work, which was largely sitting, the 50° of flexion was an advantage. The opinion of this patient and cf others that I have talked to make me feel that a straight position or even a few degrees of adduction is functionally preferable to an abducted position, although theoretically the position of abduction would seem to be preferable.

Dr. Rugh: I think that one conclusion drawn by Dr. Rogers, in the early part of his paper, was wrong: namely, that ankylosis was likely to occur in fixation of the hip. That is true if you have an inflammatory reaction in the tissue, but you must remember that the best offset to the inflammation is absolute rest and fixation. When you fix the hip you limit the inflammation and preserve the function of the hip joint. Fixation prevents ankylosis. As much motion as can be secured is desirable, provided the process is quiescent. In the vast majority of cases the trouble is not due to relighting of the tubercular condition but to strain on the parts immediately about the joint. Strain in the pelvis and tissues of the insufficiently ankylosed hip joint causes pain and disability, and restoration of the balance will in many cases relieve the strain. One can never say when a case of bone tuberculosis is cured. I have had one case break out after sixty years of quiescence.

Dr. Freiberg: I want to say that I think these persons are better off with some degree of flexion. I have not seen cases with completely extended hip. I think there should be some degree of abduction, although you don't want the hip to stick out at a right angle.

Dr. Rogers (closing): Dr. Truslow spoke of the further treatment of these cases by conservative methods; but if the cases have to be treated by traction and fixation you have the same condition. I think it is time to fix the cases permanently. In regard to not being able to get abduction by operating in the hip joint, I believe that with a free operation in the hip joint you can get any position you want.

BONE TUMORS. CENTRAL IN THE PHALANGES OF THE FINGERS AND TOES. CHONDROMA. MYXOMA. GIANT-CELL TUMOR.

BY JOSEPH COLT BLOODGOOD, BALTIMORE

A rare specimen of a central chondroma of the phalanx recently sent me by my colleague Dr. William A. Fisher of Baltimore, has stimulated me to review 8 cases—6 involving the phalanges of fingers and 2 of the toes. Those involving the fingers were myxoma or chondroma, of those of the toes one was a chondroma and one a giant-cell tumor.

I have had no other histological types of tumors in the central portion of the phalanx. A benign bone cyst lined by ostitis-fibrosa tissue has been observed in the metacarpal and metatarsal bones, but not in the phalanges. Recently I have received an X-ray film which suggests a central ostitis fibrosa or bone cyst (Pathol. No. 25646½) multiple in the phalanges of the thumb and index fingers, but the X-ray and clinical diagnosis in this case have as yet not been confirmed.

Case I. *Pathol No. 26259. Central chondroma involving the first (proximal) phalanx of the little finger; removed by amputation in June 1920.*

The specimen was sent to me by Dr. Fisher. Fig. Ia is the X-ray of the specimen sent to the laboratory. The entire phalanx is involved, but the joints seem free. At every point, except one, the bone shell is preserved; at this one point there is perforation.

The Roentgenologist before operation, expressed the opinion that, because of the perforation, one should be suspicious of sarcoma.

I will refer later to the fact that perforation of the bone shell in central tumors is not, of itself, of diagnostic significance, because it has been observed in the bone cyst, in the giant-cell tumor, in the pure myoxma, and now in this case in the chondroma.

The X-ray in this case, as compared with our other central tumors of the phalanx shows, on the whole, less expansion of the bone shell, in view of the total involvement of the phalanx, and a much more mottled shadow. The perforation is distinct with evidence of a small periosteal growth without a bone shell.

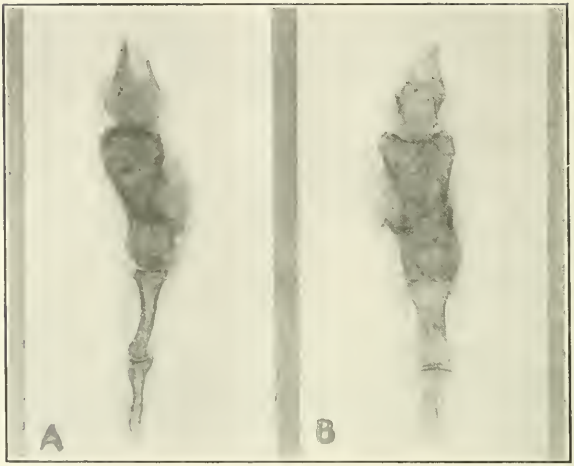

Fig. 1.

Case I. *Pathol. No. 26259.* Central chondroma of phalanx showing perforation at one point. *a*—lateral view; *b*—antero posterior view.

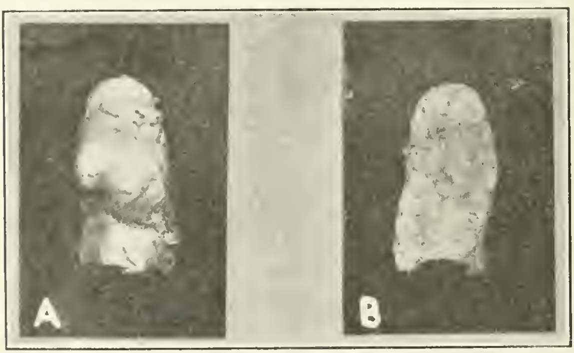

Fig. 2.

Case I. *Pathol. No. 26259.* Photograph of specimen; *a*—capsule, *b*—cut surface of the cartilaginous tumor involving the entire phalanx shown in Fig. 1

Fig. 2a and b is a photograph of the dissected specimen: *a* the outer surface, and *b* the cut surface. The bone shell is very thin; the mottled appearance of the X-ray shadow can be explained by fine bone lamellae running through the solid cartilage tumor. I dissected this specimen myself and I found that, although the bone shell was perforated at one point, the periosteum was intact, and this phalanx could have been dissected saving the tendons, but not their sheaths.

FIG. 3.

Case 1. *Pathol. No. 26259.* Microscopic picture (low power) showing cartilage, bone lamellae and minute cysts.

The microscopic sections (Figs. 3 and 4) demonstrate that we are dealing with a tumor composed entirely of cartilage in various stages of development, and the cartilage areas are separated by bone lamellae. There are no giant-cell areas and no myxomatous tissue. It is my opinion that in this case the finger could have been saved by removal of the entire phalanx as Codman did in 1901 (Figs. 9, 10 and 11).

The functional result obtained by Codman should be constantly borne in mind, because when the lesion involves a phalanx of

a finger, other than the little finger, Codman's method of resection would yield a better functional result than amputation, or the function might be improved by resection and bone transplantation. Up to the present time I have no definite case of the latter.

Clinical Note. Dr. Fisher writes that the patient was a white female aged seventy-five. The duration of the symptoms is not given. First she observed a pimple which she pricked with a needle. Then her physician incised the pimple, but found no pus. The wound healed, but this portion of the finger remained painful

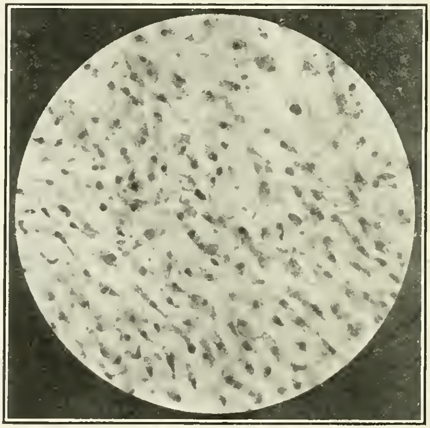

Fig. 4.

Case I. *Pathol. No. 26259.* High-power microscopic picture, showing young cartilage with some *stellate cells*, areas difficult to differentiate from myxoma.

and tender, and the patient has been unable to completely flex or extend it. For this reason an X-ray was taken and the tumor found. The probabilities are that the pimple pricked and incised had no relation to the bone lesion.

Case II. *Pathol No. 25254. Central chondroma of first phalanx of third left toe.*

Fig. 5 is an X-ray showing the small lesion of the middle of the shaft of this phalanx—an entirely different picture from Fig.

1. The patient, in this case, a white male aged twenty-one, was unaware of any trouble with his toe until he stubbed it two weeks before operation. The X-ray was taken because of pain and tenderness. There was a pathological fracture, but incomplete. Dr. Kilgore in amputating this toe at the U. S. Naval Hospital at Chelsea, Mass., in July 1918, broke the bone completely at the position of the tumor. Dr. Goodpasture, the pathologist, writes me that the sections showed cartilage. The present result has not been ascertained.

That a pathological fracture was the symptom of onset in the second case is easily explained by the position of the tumor.

These two cases establish the fact that a chondroma may be the cause of a central tumor of a phalanx of either finger or toe, and that even when small it may be the cause of a pathological fracture. (Fig. 5 Case II), or, the cartilage tumor may completely invade the shaft without perforation into the joint (Fig. 1, Case I); that the perforation of the bone shell by this cartilaginous tumor is not a sign of malignancy. Bone lamellae separating the cartilage may be preserved as shown in Fig. 3 (Case I).

Central chondromas are not frequent tumors. I have but 7 cases: In 3 cases a phalanx was involved—2 fingers and 1 toe. The femur was involved in 3 cases. One case was multiple in femur and humerus.

The third case of central chondroma of a phalanx of a finger was recognized and curetted by Dr. Warrn L. Duffield of Brooklyn, N. Y. in January 1919. He writes me that from the X-ray picture it had been diagnosed cyst or sarcoma. The patient was a white female aged twenty-five years; there had been a swelling of the proximal phalanx of the left ring finger for one year. Dr. Duffield describes the operative findings as follows: "Bone entered and soft tissue resembling granulation tissue removed with the curette, leaving a very thin shell of healthy bone; joint not invaded; no chemical disinfectants, because the operator wished to place in a bone graft, which he did from the tibia; wound closed. The patient was followed for a few months without signs of recurrence."

Dr. Duffield also writes that one pathologist called it a fibrochondroma, another a myxochondroma. The section which Dr. Duffield was kind enough to send me shows a pure chondroma with

no evidence of myxoma. I have just restudied this section (August 1920).

In August 1919 Dr. Duffield writes me that he has lost track of this patient and that he has recently had a similar case treated in a like manner with the most satisfactory results. (Sept. 1920. Patient reports cured.)

I believe it is very important to bear in mind this central chondroma of the phalanx of the finger or toe, because undoubtedly curetting will give the best functional results. If the tumor has extended beyond this as in Case I (Fig. 1) one may resect after

Fig. 5.
Case II. *Pathol. No. 2525½.* Central chondroma of phalanx of toe. Kilgore's case. Pathological fracture, no displacement.

Fig. 6.
Case III. *Pathol. No. 8630.* Central myxoma of phalanx. (Baer's case, X-ray by Baetjer).

the manner of Codman, or place a transplant into the defect. Amputation is not indicated. The following of Duffield's two cases of curetting for central chondroma of the phalanx will be of great interest to confirm this statement.

I have, however, a record of a central chondroma involving both condyles of the femur in a woman aged fifty-one. The tumor was found accidentally in an X-ray examination as the patient was

admitted to a hospital complaining of arthritis. She refused the amputation suggested at that hospital. Some time in August 1916 the tumor was explored at the Mayo Clinic, a piece taken out and diagnosed chondroma, and radium introduced. Later there was a second curetting and radium treatment. This patient was well in August 1919 three years later. Dr. Broders was kind enough to send me a section, and it shows nothing but cartilage. As far as I know this is the greatest test of curetting for chondroma. I am attempting to get an X-ray of the present result. It is possible that cartillage still remains in a quiescent state. Practically, however, the patient is well with good function and no pain.

Dr. John Douglas of New York (Annals of Surgery, 1919, lxix p. 336) reports briefly before the New York Surgical Association a central chondroma of the fibula. The X-ray was diagnosed as bone cyst above the malleolus. The patient was a female aged thirty and had observed the swelling one year. At the operation it was necessary to open the bone with a chisel; the cavity was filled with a firm gelatinous mass. The frozen section showed a cartilage tumor. The cavity was then filled with a bone graft from the tibia. For six months serial X-rays showed apparent perfect healing.

On the other hand, the central chondroma may produce huge tumors. The largest bone tumor in my series was a central chondroma of the shaft of the femur observed in the Johns Hopkins Clinic in 1897. The tumor contained many cysts.

The example of multiple chondroma of the femur and humerus demonstrates that operation is not always indicated. This boy, aged nine years, was observed in the Johns Hopkins Clinic in 1912. The pathological fracture through the shadow suggesting a central chondroma of the lower end of the femur healed, and there has been no fracture or other change for seven years. The swelling of the upper end of the humerus showing a similar picture in the X-ray was explored and curetted. The sections show chondroma, no myxoma.

Le Conte's case of central chondroma of the femur which was studied pathologically by Longcope and Lee of the Pennsylvania Hospital of Philadelphia and which I mentioned in 1910 (Annals of Surgery, 1910, lii, 159) recurred, was finally amputated, and died of secondary hemorrhage. I have been unable up to the

present time to get the complete data. Apparently there is no question that it was a central chondroma and that it recurred. (This case is to be reported by Dr. Lee.)

A similar recurrence has been recently brought to my attention by Codman of Boston, who has sent me the specimen. In this case there was a number of operations for a recurrent chondroma of the humerus, finally leading to a shoulder-girdle amputation because of recurrence in the region of the shoulder-joint.

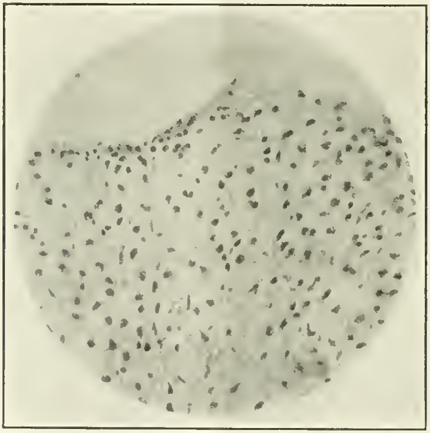

FIG. 7.

Pathol. No. 6773. Photomicograph (high power) of pure myxoma, in this case a periosteal tumor of the humerus.

I have just studied the sections from the last recurrent tumors —they are pure chondromas.

Dr. De Witt Stetten (Annals of Surgery, 1920, lxxi, 200) reported before the New York Surgical Society a recurrent central chondroma of the femur.

Recurrences, therefore, may take place in chondroma in which the sections show no myxoma and no sarcoma (cases of Le Conte, Stetten and Codman). I have observed a recurrent periosteal chondroma of the metacarpal bone which has now remained well six years after the second operation. At this operation I removed

the recurrent periosteal tumor with the cautery and preserved the bone.

When I am able to complete the study of Codman's and Le Conte's cases, I hope to make a further report on chondroma, but—to repeat the results in Duffield's two cases of curetting for central chondroma of a phalanx of the fingers will be of great interest.

Although radium seemed to have a favorable influence on the central chondroma of the lower end of the femur curetted twice in the May Clinic, in a recent observation of my own of a recurrent chondroma of the knee-joint radium had no effect. In this case the original cartilage tumor was removed by Dr. Hoke of Atlanta, and the sections were sent to me for microscopic study.

The evidence, therefore, so far demonstrates that we cannot always depend on radium for the cure of chondroma.

Central Myxoma of the Phalanx

While we have noted 3 central chondromas (2 of the fingers, 1 of the toe) we have but 2 cases of proved central myxoma, both of the fingers. In one (Pathol. No. 8630, Case III) my colleague Dr. Baer curetted in 1907, but we have been unable to follow this case. In the second case (Case IV, Pathol. No. 15597) Dr. Rhodes amputated at the metacarpo-phalangeal joint in 1914 and reported the patient well in 1916. The result, therefore, in the most important case is stll doubtful.

Case III. *Pothol. No. 8630.* Central myxoma of proximal phalanx of little finger. Fig. 6 is an X-ray by Dr. Baetjer sent me by Dr. Baer. It shows a light shadow in the proximal end of the proximal phalanx. The epiphysis is not involved. The bone shell is perfectly preserved. It has no distinct markings as in Fig. 1, central chondroma of the finger phalanx, but it is not unlike Fig. 5 the small central chondroma of the phalanx of the toe. In this case the patient was a white female aged twenty-two years; she had observed a swelling for five years; there was no history of trauma. Dr. Baer curetted. It is very interesting to note that on cutting down upon the bone shell he found a pin-point opening from which there exuded gelatinous material (I have discussed perforation of the bone shell in Case I Fig. 1). On incising the periosteum he found a thin bone shell in places completely destroyed. The cavity was filled with gelatinous material. The

line of demarkation between the tumor proper and the bone marrow on the distal and proximal ends was not sharp as one would have expected from the X-ray picture. It is also important to note that the cavity after thorough curetting was swabbed with pure carbolic and the wound closed.

FIG. 8.

Case III. *Pathol. No. 8360.* X-ray six months after operation (See Fig. 6). The central myxoma of the proximal phalanx of the little finger was curetted. The lesion hardly shows in the X-ray reproduced here.

FIG. 9.

Case V. *Pathol. No. 6892.* Central myxoma (?) of middle phalanx of middle finger (Codman's case). Resection in 1901. Followed three years, no recurrence. For result see Figs. 10 and 11.

I saw the tissue in the fresh. It was gelatinous, mucoid, friable, not unlike tapioca. The frozen as well as the most carefully fixed sections showed a pure myxoma similar to Pathol. No. 6773, a previous case of pure myxoma of the humerus (Fig. 7). Unfortunately this section has been lost and cannot be restudied. I feel, however, confident that the diagnosis of myxoma was correct.

The X-ray taken six months after operation strongly suggested almost complete ossification. Fig. 8.

Case IV. *Pathol. No. 15597.* The section in this case was sent to me by Dr. Rhodes from the Jefferson Hospital in Roanoke, Va. The patient was a white male aged sixty-two; the swelling of the right ring finger had been present for twenty years following an injury. The X-ray was diagnosed a bone cyst. The operation consisted of amputation. Dr. Rhodes sent these sections with the statement that they had been diagnosed "cystic, with beginning sarcomatous changes." My notes in 1904 on the microscopic section is as follows: "There are lamellae of bone in the mesh-work of which tissue resembling ostitis fibrosa is seen. This apparently represents the bone capsule. Within this the tumor is a pure myxoma." (See Fig. 7.)

In addition to these 2 cases which we have every reason to believe are pure myxomas, there are 2 other cases: Codman's case (Case V, Pathol. No. 6892) and Dr. George's case (Case VI, Pathol. No. 12206).

Case V. *Pathol. No. 6892.* Central myxoma (?) of second phalanx of ring finger.

As far as I know, this is the first case in our own literature, but its chief interest is the excellent functional result after the excision of this middle phalanx. Fig. 9, the X-ray sent me by Dr. Codman, shows that the entire phalanx is involved, similar to Case I, but the bone shell is more distinct than in Case I. When compared with Case III (Fig. 6) the X-ray in Codman's case is much more mottled. I think one can conclude from these four X-rays that there is no way of making a diagnosis between myxoma, chondroma and a cyst from the X-ray plate only.

Figs. 10 and 11 are reproduced from Codman's original article (Boston Med. and Surg. Jour., 1904, cl. 211). One shows the X-ray after operation, and the other the strength and function of the

finger. This patient was a white female aged forty, and the swelling of the phalanx had been present for more than a year. After removing this phalanx without cutting into it, Dr. Codman found a shell of bone containing a cavity filled with a straw-colored serous fluid and lined by a soft translucent myxomatous membrane. This is rather the gross picture of a cyst, except the lining connective tissue is not soft, but leathery in the cyst. Muller has reported

FIG. 10.

Case V. *Pathol. No. 6892.* X-ray result in Codman's case (see Fig. 9).

FIG. 11.

Case V. *Pathol. No. 6892.* Functional result in Codman's case (see Figs. 9 and 10).

such a cyst in a metacarpal. Dr. Whitney, the pathologist in Dr. Codman's case, described it as a myxochondroma, but the sections were lost.

Case VI. *Pathol. No. 12206.* Fig. 12 is an X-ray sent me by Dr. W. George of Boston. The markings are not unlike Codman's case (Fig. 9) and it resembles Baer's case in that only one-half of the phalanx is involved, while in Baer's case the shadow is round, in George's case it is somewhat square.

Again we have evidence that the same tumor in the same bone may produce pictures which differ in some respects. One would

rather expect that the myxoma or the chondroma in a phalanx would grow somewhat uniformly, but up to the present time such uniformity has been absent in all the bones of the skeleton.

Dr. George wrote me that the patient was a white female, aged thirty, and that the swelling had been observed two years. At that time (1911) I suggested exploration and curetting to be followed by pure carbolic acid and alcohol, or, I added in my letter; "if it is giving her no trouble, leave it alone." I warned Dr. George of the danger of curetting a myxoma without such chemical destruction. I was of the opinion then that a differential diagnosis could not be made from the X-ray.

In my contribution on bone cysts (Annals of Surgery, August 1910 vol. llii, 150) I collected at that time 5 examples of central lesions of the phalanx which I thought were myxomas, because I

FIG. 12.

Case VI. *Pathol. No. 12206...* X-ray sent by Dr. George of Boston. Not report on operation.

FIG. 13.

Case VII. *Pathol. No. 17536.* Central giant-cell tumor of end phalanx of toe. Specimen sent by Dr. McGill.

had examined histologically Baer's case. At that time Dreesman and Blake had curetted, as was done by Baer, but in these 3 cases as well as in the 2 cases curetted later by Duffield for central chondroma, we have not the results to justify the belief that curetting will effect a cure.

Central Giant-Cell Tumor of End Phalanx of Toe

Case VII. *Pathol. No. 17536.* The specimen shown in Fig. 13 was kindly sent me by Dr. McGill of Butte, Montana. A longitudinal section has been made through the toe and phalanges. The marrow of the end phalanx has been practically replaced by a reddish tumor, but one can feel, although not see, that spicules of bone are present throughout the tumor. The patient was a white male aged eight years; pain and swelling had been present four months. No X-ray was sent me. It was the first giant-cell tumor of a phalanx that I have observed. In the upper extremity we have one giant-cell tumor of a metacarpal bone; in the lower extremity the giant-cell tumors have been observed in the astragalus, os calcis (2) and in the phalanx in this case.

These tumors are therefore comparatively rare. Fig. 14 is a low-power photomicrograph of the entire tumor, except a portion of its capsule. This picture shows chiefly the presence of bone in islands throughout the tumor and that the bone shell is not continuous, but here and there destroyed. Microscopically, I was unable to demonstrate giant cells outside the bone capsule. (Fig. 15).

The tumor, when studied with the high power seems to belong to the giant-cell tumor of the epulis type (Fig. 16).

Although the giant-cell tumor involved the phalanx beneath the nail, it is not the subungual perithelioma observed by Muller and previously reported by me (Progressive Medicine, Dec. 1906, p. 267), because this tumor never attacks bone and is of different histological appearance. One interested in soft-part finger tumors is referred to my review of this subject and the literature in Progressive Medicine (Ibid. p. 262). None of the authors then reviewed had observed a medullary sarcoma of a phalanx, and Heineke was the only one who had noted a cyst in a phalanx, and in his case it was situated in the great toe of a patient with multiple bone cysts of the skeleton.

It is also worthy to note that in my own list there is not an example of a malignant periosteal sarcoma of a phalanx, and there has only been one case of one in the metatarsal.

It is very interesting to compare this absence of malignancy in periosteal and central tumors of the phalanges with a similar finding in the so-called fibroma of the tendon-sheath. This tumor is really a granulation-tissue tumor and often of the xanthoma type. Attention has been frequently called in the literature to the fact that it is practically never malignant when situated on the fingers or toes, but when situated on the tendon-sheaths of the hand or

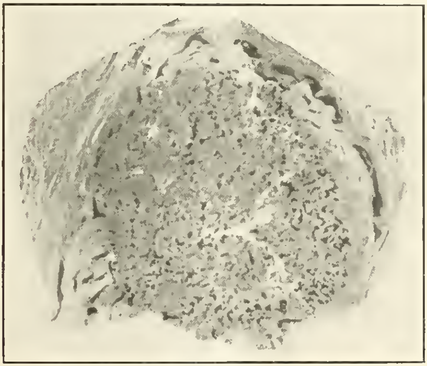

FIG. 14.

Case VII. *Pathol. No. 17536.* Photomicrograph (low power) shows the islands of bone and the broken bone shell in a giant-cell tumor (See Fig. 13).

foot, it has been observed to be malignant in a few cases, and when situated above the ankle or wrist it is more apt to be malignant than benign. This fact so frequently quoted in the literature, is confirmed by the cases observed in the Surgical Pathological Laboratory of the Johns Hopkins Hospital.

Supplementary Remarks. For the past year I have been concentrating on the study of bone tumors, and in the past two weeks I have gone over again and again the sections of all the bone tumors diagnosed chondroma, myxoma, chondromyxoma and myxo- and chondrosarcoma. Apparently three groups are not difficult to

recognize with the microscope—the pure chondroma (Fig. 3), the pure myxoma (Fig. 7) and the sarcoma, whether it is associated with cartilage or myxoma. But it is very difficult to distinguish certain areas in the chondroma in which the cartilage cell is not definitely situated in its little lacuna and become permanently imbedded in the intercellular chondrine, because, mixed with the youg round cartilage cells, there may be a stellate cell not unlike that in the pure myxoma. (Compare Fig. 4 with Fig. 7).

Fig. 15.

Case. VII. *Pathol. No. 17536.* Photomicrograph (low power) shows the uninvolved capsule with some remains of the bone shell, the giant-cells and small islands of bone in the tumor.

Our restudy has been complicated by the fact that myxomatous tumors preserved in formaline or alcohol when reblocked and cut have practically lost their intercellular substance and fail to show the typical pictures after five years. So many of our best specimens could not be restudied. Fortunately the case in Fig. 7 had been photographed. But even the section from which the photograph was made has faded. This is not so with the typical areas in the cartilage tumors, but with the softer portions of the cartilage tumors composed of young cartilage with many stellate cells, the

same destructive process is observed in the gross specimen and in the old section. I am therefore skeptical of the correctness of our diagnosis of some cases of chondroma. That is, some of our cases called chondroma may contain myxomatous tissue.

These cases of chondroma and myxoma have not come in frequently enough, and we have not always been able to obtain the fresh tissue for frozen sections. There is an opportunity for a re-investigation of the best differential stains for frozen sections and best method of fixation for permanent sections.

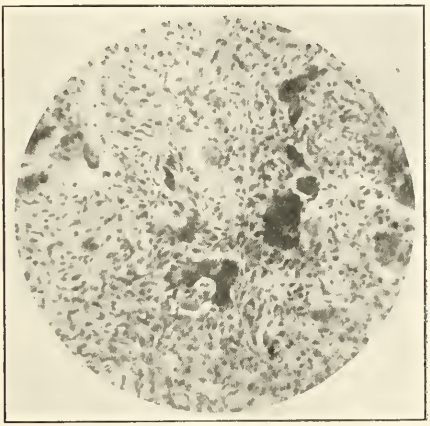

FIG. 16.

Case VII. *Pathol. No. 17536.* Photomicrograph (high power) showing the giant cells and the rather typical granulation-tissue-like matrix in which the giant cells are imbedded; also islands of bone.

I am of the opinion that it is of practical importance to differentiate chondroma from myxoma. The myxoma seems to demand more radical treatment.

In my own practice I, however, propose to treat myxoma and chondroma alike, until I am certain that we can differentiate one from the other. I am not quite sure that Case I (Fig. 1) does not contain some myxomatous tissue.

The study of the myxomas will shortly be published in the Annals of Surgery.

A central chondroma of the lower end of the femur (Journal of Radiology, March 1920, i, 180 Fig. 15, Pathol. No. 22016) which had been subjected twice to curetting followed by radium, is well (August 1920) with good function three years after the last treatment. In restudying the sections from this case it appears to be a pure chondroma with no areas of young cartilage and no stellate cells, but the sections are poor, so that we cannot be absolutely certain.

A second case of apparently pure chondroma involving the knee-joint mentioned in the same article (p. 208, Fig. 85, Pathol. No.24367) has recurred. In this case the tumor was removed from the knee-joint by enucleation in April 1919. There was definite evidence of recurrence some time in July 1920, after the manuscript of my article in the Journal of Radiology had been sent to the publishers. Most thorough radium treatment had no effect. Two days ago I was compelled to amputate the thigh, because the recurrent tumor involved the knee-joint so extensively that removal with preservation of function was out of the question, and then I feared recurrence from transplantation even if a conservative operation had been possible. With the help of Dr. Terry, Professor of Pathology in Vanderbilt School of Medicine, we were able to make a most thorough frozen-section study. The tumor resembles that illustrated in Figs. 3 and 4 (Case I), that is, there was no positive evidence of myxomatous tissue. Yet, how differently this chondroma, apparently more completely removed, has behaved as compared with the one in the lower end of the femur which was only curetted and treated with radium.

Again, in the Journal of Radiology (pp. 190 and 191, Fig. 56, Pathol. No. 10150) I describe an exostosis of the lower end of the femur which was removed piecemeal. The tumor was apparently composed chiefly of bone. When this patient died four years later of recurrence, I found on re-examination of the sections, areas of myxoma.

PREVIOUS COMMUNICATIONS BY THE AUTHOR

Annals of Surgery, August 1910: Bone Cysts, Ostitis Fibrosa, Giant-Cell tumors, Bone Aneurysm. 43 illustrations and literature.

Annals of Surgery, August 1912: Conservative Treatment of Gient-Cell Tumors; Bone Transplantation. Literature on Giant-cell Tumors.

Annals of Surgery, April 1919: Giant-cell Tumors. Destruction of Bone Shell or its Perforation Not a Sign of Malignancy. 25 illustrations.

Transactions of the Medical Association of the State of Alabama, April 1919: Brief review of benign and malignant bone cysts. 20 illustrations.

Journel of Radiology, Volume 1, March 1920, Pages 147 to 238, Figures 1 to 89; X-ray Diagnosis of Bone Tumors. 89 illustrations.

American Journal of Surgery, September 1920: Bone Tumors, Benign and Malignant. A brief summary of the salient features, based on a study of some 370 cases. 4 illustrations.

The eighth annual congress of the American College of Surgeons convened October 10, 1920. The congress was entertained by the Canadians at Montreal. About 3,000 surgeons were present, and some 670 new members were initiated. It is interesting to note that 35 of these were from South America.

Among the notable foreign guests were Sir Berkeley Moynihan of Leeds, England; Sir William Taylor of Dublin, Ireland; Mr. A. Carless of Essex, England; and Sir Auckland Geddes, the British Ambassador.

The events of the congress may be classified under the following headings:

1. Introductory.

2. Clinics, scientific papers, and various exhibits.

3. Consideration of standardization work in hospitals, and other "things medical," by assembled committees.

4. Convocation of American College of Surgeons. Adjournment.

1. In the opening exercises, Sir Berkeley Moynihan presented, on behalf of the Royal College of Surgeons, a beautiful mace and with it their kindly greeting. The address was a masterly talk by a refined English medical man. It intensified the feeling of fellowship already existing, not only between Canada and the States, but between all American and Great Britain.

Dr. W. J. Mayo gave an address as retiring president. He emphasized the progress made in surgery in general during the past year, referring in particular to abdominal surgery. He pointed out some of the advantages of group practice, and recommended a closer affiliation between the biochemist, physiologist, physicist, and the bedside practitioner. At another time during the congress, he again referred to group practice and warned the members that unless in some manner they accomplish greater co-operation and less competition, then health insurance legislation and state control are surely coming.

Sir Berkeley Moynihan then gave an address upon the Murphy Memorial. It was an eulogy of the late Dr. J. B. Murphy, master surgeon of his time. A brief synopsis of the history of

medicine, illustrated by lantern slides, served to carry the mind of the audience from Hippocrates, as the father of all medicine, up through the ages to the present day, and thus to place correctly in the Hall of Fame the memory of Dr. J. B. Murphy.

2. Montreal clinics were taxed to accommodate such an assembly of America's surgeons. Most visitors found a fair amount of operative work however, in the particular fields they desired, whether it was the head, extremities, pelvis, abdomen or thorax.

Most of the scientific programs were full, but not over-long. Speakers were held to time, and their talks were snappy with emphasis on the cardinal essentials. Just enough of the technical and didactic was given to stimulate but not to tire the practical surgeon.

There were exhibits of Sir William Osler's personal collection of pathological and anatomical specimens.

The exhibits of McGill University were most interesting; likewise the Canadian war exhibit and others. The French and (to a lesser degree) Canadian elements in the congress environment were just sufficient to remind one from the States that he was really in a foreign country and being delightfully entertained.

3. The work of standardizing hospitals is no longer new. Truly it is less far advanced than the standardization of medical colleges, for example; but none the less certainly under way. Not only has the A. C. S. undertaken to push this splendid activity, but the A. M. A. through its state associations, the American Hospital Association, both Catholic and Protestant, the Association of American Medical Colleges through its search for interneships, et cetera, are accomplishing much.

4. The terminal session of the congress consisted of convocation services, at which the newly elected candidates were presented, and of addresses by President George E. Armstrong of Montreal and Sir William Taylor of Dublin. Dr. John Deaver was elected president for the ensuing year, and it is likely that the next congress will be held in his home city, Philadelphia.—*J. Stanley Welch, Lincoln, Nebr.*

Editorial

READING THE BIBLIOGRAPHY

The editor finds that there are a few of our readers who consider the bibliography published in each issue to be occupying space that might better be devoted to something else. On the other hand, there have been quite a few letters indicating there are those who appreciate and enjoy, and profit by the pages devoted to this monthly index of current orthopedic literature.

To the editor himself, the bibliography has always been an interesting, as well as a profitable literary pastime. By way of directing attention to the several useful and entertaining features of the monthly bibliography which is published in this issue, it is desired to point out some of the details which may be elicited by a perusal of the collection of authors and titles for the current month.

One is attracted first of all, by the fact that there has recently been published in the Archives de Medicin et Pharmacie, Vol. 72, 1920, a collection of articles which will stir the memory of every officer who served with the British and the French. Included in the collection in this one publication, are articles by Bronomo, Sir Arthur Bowlby, DePage, Leriche, Neuhof, Tuffier (who talked to us so well at the Red Cross conferences in Paris), and Willems. Col. G. E. Brewer, who visited many of the hospitals in France, in this same issue reports his knee joint experiences in an evacuation hospital in France. Two of the younger men, Jelks and McGuire, now have articles published in widely separated portions of the country. Both Dr. Jelks and Dr. McGuire are young officers who did fine work as divisional officers at the front, and were later on duty at Savenay.

W. G. Turner is one of the Canadian surgeons who has done much fine work. The British used the Turner Splint in nearly all of their War Hospitals to assist in the extension and flexion of stiffened joints.

The editor of the Journal had the pleasure of meeting Dr. Turner's brother, General Turner, when he was touring the British Isles with the Premier of Canada, in 1918.

Ellis Jones of Los Angeles, and Fosdick Jones of Denver, whom most of the readers of this Journal know, have recent articles on fracture of the spine, of the tibia, and fracture of the femur. All of these articles have a personal as well as a professional interest to many orthopedic surgeons.

On the other side of the balance, one may find articles to arouse discussion or debate. There is for example, the article of Dr. E. H. Smith of San Francisco, which was published in the Medical Record. Dr. Smith would lead us away if he could, rather than follow on with the lessons of the war in regard to fractures. The editor is too critically inclined to discuss Dr. Smith's article at length here, but hopes that someone will take issue with some of his statements and uphold the present tendency toward standardization of splints.

Dr. Yergason has an article on the use of the Sinclair skate in Hawley's high bridge splint. The editor has not seen this article, but he has seen the high bridge splint, and feels that most readers should adhere in the use of the Sinclair skate more closely the teaching of Thomas and Sir Robert Jones than can be done by any such radical departure as this particular splint.

The editor desires to encourage all readers of the Journal, not merely to glance at the biblography, but to read it through for the sake of meeting old friends, for the sake of finding out what is being published in orthopedic literature, and also that interesting titles may be followed to the journal in which the full text of the article is published. In this way our readers and writers elsewhere may keep more closely in touch with things orthopedic than can be done in the pages of any single journal except through a thorough and interesting biblography.

News Notes

Dr. J. Torrance Rugh, Clinical Professor of Orthopedic Surgery and a member of the American Orthopaedic Association, delivered the address at the opening exercises of the Women's Medical College of Philadlephia, September Twenty-fifth.

Dr. R. Wallace Billington has removed his offices to 180 Eighth Avenue, North Nashville. He has associated with him Mrs. Louise Beatty of the Dominion Orthopaedic Hospital, Toronto, as assistant in physical therapy.

Dr. William Arthur Clark, formerly of St. Lukes' Hospital, Chicago and the Mayo Clinic, has announced the opening of offices for the practice of Orthopedic Surgery at 408 Central Building, Pasadena, California.

Dr. Edward S. Hatch of New Orleans has removed his offices from the Maison Blanche Building to 3439 Prytania Street. Miss Sue Cannon Price in charge of medical gymnastics is associated with Dr. Hatch.

There will be a meeting of the Central States Orthopedic Club in Chicago on Nov. 19th, and in Milwaukee on Nov. 20th, 1920. The club was organized in 1913 and since that time meetings were held once or twice during the year, except during the period of the war. The organization has grown rapidly and the widespread interest manifested gives indication that the coming meeting will be very well attended. The meetings thus far have been largely clinical in character, no papers being read. Free and informal discussion has been a feature of importance in the meetings thus far, and has made them enjoyable and profitable.

Doctor R. Tunstall Taylor of Baltimore, writes that the Kernan Hospital has received, recently, a gift of twelve acres adjoining the Hospital grounds, which are now within the city limits. The Hospital is enlarging its agricultural activities, among other

things planning for a chicken farm of three thousand laying hens. The income to the Hospital last year exceeded expenses by three thousand dollars.

Doctor Taylor writes also that a group associated with him for private practice in Baltimore now consists of the following:

Doctor J. Fletcher Lutz, Roentgenology, late Major and Chief of Service at Ft. McHenry; Doctor S. Cole Bowers, Roentgenology, Franklin Square Hospital (Pediatrics); Doctor Benjamin Tappan, Johns Hopkins Hospital; Doctor J. N. Reik, Eye, Ear, Nose and Throat Hospital; Doctor George H. Grove, Internal Medicine and Clin. Micros., Union Memorial Hospital and University; Doctor J. F. Bell, Dental Surgeon; Doctor A. Ben Jaeggin, Physiotherapy.

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Prepared by Dr. J. E. M. Thomson, Lincoln, Nebraska.

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Current Orthopaedic Literature

Rheumatism. Dr. K. Port. *Archiv f. Orthopaed. und Unfall-Chirurgie.* Band XVII, Heft 3, 1920. Seite 465-506.

Chronic rheumatism is the collective name for a large group of affections of the joint-muscle and other connective tissues. The name is only in use because exact pathologic knowledge is still wanting. The author claims for this group the name chronic rheumatism because: it allows a distinct separation from the other diseases so named and it offers a uniform character which permits a definite diagnosis and a differentiation from all the similar conditions.

This group possesses:

1. A uniform etiology, namely, a lingering cold. The exposure to cold never occurs when the patient is in motion, but when muscles and joints are at rest. Therefore it is prevalent in people with sedentary occupations.

2. The characteristic symptomotology is: Long duration with acute exascerbations of pain, which are distinctly dependent upon "catching colds" and the change of weather.

3. A constant clinical finding: infiltration of tissues of the joints, of the muscles, the subcutanous tissues and nerves. This infiltration is distinctly palpable and resembles the residue which remains in tissues after trauma. A similar induration, well circumscribed and of various sizes, can be palpated.

4. The specific treatment is massage and exercises. The massage must be thorough and painstaking. Each and every point of infiltration must be discovered and kneaded most thoroughly. The treatment is tedious but, if carefully carried out, will lead to complete recovery in nearly all cases. The success of this treatment is so certain, that the author regards it as a pathognomonic sign of this group of rheumatism.—*A. Gottlieb, San Francisco, Calif.*

Treatment of Acute Polyarthritis By S. W. Boorstein, M. D., *Med. Record,* July 17, 1920.

If you see the case early look for the source or sources of infection and clear them up if you can. Do not stop at the teeth, but examine the throat. Infected tonsils, even if not enlarged are often the cause of infectious arthritis. The intestinal tracts and genito-urinary tract should not be forgotten. Try to remove all sources of infection as soon as possible, even if you are not sure that they are the causes.

General Treatment

Environment.—As long as the patient is guarded against exposure to cold and moisture, he may be kept in the city.

Combating the Infection.—Increase elimination of toxins through the natural channels. In the beginning give strong purges, then laxatives should

be given. Mineral oil may be used freely. Enemas or high colon irrigations. Diuretics should be given freely.

Diet.—A full nutritious diet is necessary. Meat should not be withheld even during the acute stage. Plenty of milk and fruit (cooked or raw). Two or three glasses of buttermilk a day.

Medication.—All forms of salicylates should be avoided. Only those drugs aimed to promote digestion, proper bowel activity, proper circulation, and proper character of the blood should be used. (Strychnine, Arsenic, Iron preparations.) In chronic cases Cod liver oil can be added. During the acute or subacute stage, hypodermic injections of Sod. Cacodylate in ¾ to 1¼ grain doses, every four or five days, have been found of great help in increasing the resisting power. Tr. Gelsemium m v t. i. d., may be used to relieve pain. If intestinal putrefaction is present, guaiacol carbonate grs, v. t. i. d. may be given. The author believes that it is absolutely worthless to give vaccines, perhaps even harmful.

Local Treatment

Immobilization.—As soon as the patient complains of pain, the joint should be immobilized in a well padded circular plaster cast. The position of the joint should be properly selected, the knee in extension, the ankle at right angles, the elbow flexed, the wrist slightly hyperextended. The cast should be left on for eight or ten days and is then halved. It is then left on during the night and only part of the day, being removed during the application of other local measures. The duration of the wearing of the plaster is gradually shortened.

Active hyperemia.—Contrast baths, or alternate compresses of hot and cold water. Bathing limb in hot water with Epsom salt. The bathing may be done three or four times daily. Baking is of great benefit. It should be used after the cast has been opened. The temperature of the machine must be gradually increased to 250° to 300° F. The application should be given for ¾ hour. Electrically heated apparatus is the best. Baking should be given every day during the acute attack; later on three times a week.

Bier's passive hyperemia produced by means of a thin elastic bandage, is also of benefit. The constriction must be just enough to cause a narrowing of the superficial veins. The application is painful during the acute attack if it is not applied correctly. Begin to use it two or three hours a day and increase duration of application gradually to 22 hours a day, the bandage being removed for one hour twice daily when the limb is to be raised to allow the return of circulation.

Massage.—This is of the greatest value if it can be carried out properly. It is that part of the treatment most commonly abused and perhaps also the one responsible for many disabling deformities. Massage should not be used as long as redness, tenderness and other signs of inflammation are present. It should be given three or four times a week in the acute cases. In chronic cases it may be given five times a week. The massage should be given mostly to the muscles and not much to the joint itself. In hospital cases general massage and particularly abdominal massage should be added.

Exercises.—Active exercises are of the greatest value and should be begun as soon as the inflammation begins to subside. Passive exercises may be used in the chronic cases. Occupational therapy has been found superior to the use of Zander machines.

Hydrotherapy is of benefit; but it is not advisable to depend entirely on this mode of treatment and send patient away to spa.

Electrical treatments.—Valueless, and some forms even harmful.

Conclusions

1. The disease has no relation to rheumatism and anti-rheumatics should be avoided.
2. A focus of infection should be looked for in every case of arthritis where tuberculosis, malignancy or trauma is not self-evident. The finding of a focus does not mean that this is the only one. The source of infection suspected should be removed if possible.
3. Monarticular arthritis demands the same careful investigation as a case of polyarthritis, for one can never tell when the former may merge into the latter.
4. Prophylaxis in preventing systemic infection and keeping the genito-urinary and gastro-intestinal tracts in good condition is essential. Removal of chronic foci anywhere in the body is imperative as a prevention of progressive ill health.
5. The arrest of infection does not mean that the joint condition will be cured, unless orthopedic measures are employed.
6. General treatment, such as good hygiene, good food, tonics, is essential to success.
7. Acutely inflammed joints should be put in well padded plaster casts.
8. When acute symptoms subside, local treatment to the joint in the form of active and passive hyperemia, hydrotherapy, massage, active and passive exercises, should be administered regularly with great care and patience, and kept up for a long time.
9. Deformities should be prevented by steadying the joints in the best positions during the acute stage.—*Mark Cohn, M. D.*

Objective Symptomatology of Foot Strain. Albert H. Freiberg, M. D., Cincinnati. *Jour. A. M. A.*, August 14, 1920, Vol. 75, No. 7.

We are unable to tell, from the appearance of a foot to what extent it is or may be the cause of suffering and consequent disability. A foot may perform its functions painlessly and without fatigue for a long time in the presence of abnormal relations between the foot and the leg, or relations between the bones of the foot. Individuals with such abnormal conditions bear in them the potential factors of disability, which require only the added element of unusual functional demands, trauma, or infection to call forth a situation which will bring them to us for aid. When this time comes it is often the case that the symptoms are localized at a distance from the foot which, after

correct analysis, must be recognized as the fundamental source of trouble. Failure to recognize this means failure to apply the remedy which will be effective.

What is not generally appreciated with regard to the foot is that a very large number of persons, by reason of their foot gear, have reduced their muscular working limit to such an extent that the strain of further function makes itself felt in loco or at a distance without apparent cause.

The foot pains are a reaction of the periosteal attachments of the ligaments which are under abnormal stress on account of muscular insufficiency. With visible mechanical maladjustments at the lower end of the leg, disturbances of the lines of weight bearing and muscular balance may hinder function in the knee, hip and even the spinal joints. Many individuals with feet muscularly impaired are succeeding in maintaining a correct general posture, but this cannot be done without improper expenditures of muscle power elsewhere.

A thoughtful examination of the anatomy of the foot with respect to the purpose of its structure may well be looked to in order to form a conception of the true meaning of some of the abnormal manifestations there to be observed. That the foot is not meant to be a merely passive support for the body, a pedestal on which to stand and walk, but rather a living organ with which to stand and walk, has become a truism, but one which is constantly being forgotten. Too much has been thought and said about the arches of the foot; too much, in other words, about its intrinsic structure and too little about its mechanical relationship to the rest of the lower extremity.

The most striking feature about the mechanism of the foot when regarded as a whole and with respect to its functional relationship to the leg, is the fact that its construction is such that a means must be provided to keep it in line with the rest of the lower extremity, during weight bearing. The transmission of the body weight to the ground takes place through a line corresponding to the axis of the tibia, passing through the center of the tibio-astragaloid joint approximately, but which passes thru the os calcis not at its center but decidedly mesial or internal to this point. This may be seen in any anatomic drawing or ligamentous preparation of the foot, viewed from behind. The resulting tendency of the foot as a whole to cant inward, on the leg unless prevented by muscular action is emphasized in every description of the foot mechanism.

Roberts calls attention to the "globular contour of the inferior bearing surface of the os calcis." It seems quite right to say that the obvious purpose of this condition of mechanical instability is to provide for elasticity of gait through the muscular control.

The ligamentous checks to motion in pronation and abduction lie in the internal lateral ligament of the ankle chiefly. This ligament, otherwise spoken of as the deltoid ligament, is a composite structure made up of several bands. The band of greatest interest is that one which, attached above to the tip of the internal malleolus, has an almost vertical course downward, being inserted below to the innermost border of the sustentaculum tali. This band is called the tibiocalcaneal ligament. It may easily be seen that when any movement in pronation is not sufficiently controlled by muscular action, stress

will first of all fall on the tibiocalcaneal ligament; if we imagine the os calcis being allowed to cant inward, as it will tend to do under these circumstances, this sea will be the seat of a cross-breaking strain where it is attached to the inner border of the sustentaculum. Since pronation and abduction of the foot are practically always associated, the tendency is for the head of the astragalus to rotate outward on the os calcis; this implies a movement inward of the posterior part of the astragalus. The ligamentous check to this movement is found in a short band which is attached to the posterior process of the astragalus behind, and which passes almost horizontally forward to the posterior end of the sustentaculum. In the case of latent weakness of the muscles controlling supination and abduction, even though no deformity in the opposite direction be apparent, we shall be able to comprehend that abnormal stresses are continually falling on these two ligamentous bands and that their periosteal attachments are under these circumstances likely to be tender to pressure, for this reason.

I test the sustentaculum for tenderness. Probably all people who had undoubted foot strain were tender at this place, whether deformity of the foot was present or not.

1. Persons who have symptoms which may be attributed to weakness of supination and adduction of the foot practically always have tenderness of the insertion of the tibiocalcaneal ligament into the sustentaculum tali, or at its posterior extremity.

Many persons who have no foot symptoms have tenderness on pressure over this point; this is also true of many persons who have no symptoms attributable to the lower extremities at all.

4. Most persons with strong symptomless lower extremities are not tender on pressure over the sustentaculum. This tenderness is to be regarded as indicative of potential weakness in adduction and supination. This is true in proportion to the ease in which tenderness is called forth.

The functional interdependence of the individual segments of the lower extremity has been referred to in the first part of this paper. This has long been recognized in an indefinite manner as the result of clinical experience. Patients with foot strain have told us time and again how they suffered from fatigue and pain in the legs, thighs and back, and we have been able in such cases to dispose of these symptoms by attention to the malposture of the feet. Lowman has shown the importance of the external rotators of the thigh in maintaining the proper relations of the leg to the foot; he has set forth the possibility of assisting the restoration of normal muscular balance by gymnastic cultivation of this group of muscles. It has been my experience to find this statement corroborated in practice. In fact, I am now disposed to regard the exercises of the external thigh rotators as by all means the most important at my disposal.—*Leo C. Donnelly, Detroit.*

PREVENTION AND TREATMENT OF WEAKFOOT IN CHILDREN. By Percy Willard Roberts, M. D., New York. *Jour. A. M. A.*, Vol. 75, No. 4, July 24, 1920.

It has been demonstrated that rotation of the os calcis on its anteroposterior axis controls the degree of strain which the longitudinal arch is called on to bear, and that by directing the course of such rotation outward, foot strain may be prevented and weakfoot overcome.

If through mechanical support and muscle training its balance is maintained thru the period of growth, there will result a normal foot, architecturally correct and muscularly strong enough to meet all the demands made upon it in the years to come. As foot troubles in adult life have their origin many times in improper development of the pedal tissues in early childhood, it is evident that the subject under discussion is one deserving of more consideration than it usually receives.

At the end of the first year of life, when the baby begins to stand, the bones are hardly more than an orderly arrangement of cartilaginous masses. Centers of ossification are present in the astragalus, os calcis and cuboid at this time, but they do not appear in the other bones of the tarsus until one to three years later. They will grow into perfect or imperfect bones as circumstances may ordain.

The three factors which commonly disturb the formation of the foot are improperly designed shoes, unequally developed leg muscles, and a deviation in the normal mechanical relations between the tarsus and the leg. The bottom of the os calcis is approximately an arch and the weight of the body is resting on a single point representing the center of balance of this bone. So long as the thrust of the body weight is carried directly over the center of balance, the bone will not tilt; but if it is shifted, let us say to the medial side, the bone will rotate inward. The ligaments on the bottom of the foot bind the os calcis and the bones anterior to it so firmly together that they must move as one mass. Inward tilting of the heel bone will lower the inner border of the foot and pronation becomes an established fact with the consequent evil of strain on the ligaments of the longitudinal arch. The result of long-continued strain of this nature will ordinarily be stretching of these ligaments and the production of weakfoot. The prevention of this fault in attitude is possible if the young foot is properly trained. The most important single factor in the development of a normal arch is the maintenance of the upright position of the os calcis during the period of growth. In some cases it is necessary only to raise the inner border of the heel of the shoe to insure this result. In others, some firm mechanical appliance capable of grasping the heel will be indicated. It is the custom of the day, when a child has weakfoot, to put a plate in the shoe which presses up the arch. This seems physiologically and mechanically wrong,—physiologically wrong because constant pressure on the plantar tissues interferes with their development, and mechanically improper because the force is inefficiently applied. The correction can be much more readily obtained by an apparatus whose effective force is applied directly to the heel and the permanence of the results will be more certain.

Much can be done toward maintaining the proper alignment of the bones of the foot by muscle training; but the use of this measure must be deferred

until such time as the child is old enough to co-operate intelligently; therefore the question of shoes takes second place in any reasonable scheme of prophylactic supervision of foot growth.

During the first ten or twelve years of life, the foot should have ample room to expand laterally as well as to grow in length. To meet this condition, a proper shoe may be described as one which is sufficiently wide at the ball of the foot to avoid crowding the heads of the metatarsals together when the wearer is standing and in which the inner and outer borders of the sole maintain a straight line well beyond the great and little toes. The popular idea that the anterior part of a shoe should swing inward, a design so often seen in so-called "orthopaedic" lasts, is based on an entirely erroneous conception of the normal foot.

Although definite muscle training cannot be carried out effectively at an early age, something can be accomplished by teaching the child to walk on its toes and by devising simple games that will bring this attitude into play, thus helping to develop the strength of the anterior and posterior tibial muscles.

Maintenance of the upright position of the os calcis, or its rotation outward if there is any inclination to pronation may be comfortably achieved by the plates. Their efficiency has been proved in many hundreds of cases in the last five years, and they have been found to possess a definitely curative value in the treatment of weakfoot in children. Their function is to rotate the heel and this is accomplished by tilting the floor of the plate under the calcaneum and by pressure of a thumblike flange which engages the tissues over the inner side of the bone toward its posterior extremity.

Striking demonstrations of the actions of these plates is seen in cases of paralysis of the anterior tibial muscles which allows the foot to roll into the valgus position. Mild types of this deformity can be controlled by this device until the patient is old enough to undergo operation for a permanent correction.—*Leo C. Donnelly, Detroit, Mich.*

Injuries of the Spinal Cord. Alan Newton, M. D. *Medical Journal of Australia*, Vol. II, p. 30. July 10, 1920.

This paper is based on extensive research during the recent war. The subject is discussed under various headings, the first of which is:

1. Injury of the Spinal Cord without Injury of the Vertebral Column.

The term concussion is usually employed in a loose manner, but it should be used only to indicate the cause of an injury. It occurs usually as the result of nearby explosion or other compressing force producing gross lesions of the spinal cord without coincident lesion of the spinal column. The character of the lesion (Holmes) is diffuse and irregular in distribution, diminishing gradually from point of maximum disturbance, consisting of primary necrosis and parenchymatous change in cells and fibers associated with edema and small scattered hemorrhages. Similar results are reported by Claude and Lhermitte.

The author's experiments showed that the spinal cord was extremely sensitive to slight concussion and compression. The clinical signs (Roussy and Lhermitte) are extraordinarily variable and consist of interference of motor conductivity even to the extent of being indistinguishable from anatomical sections of the cord, making differential diagnosis difficult. They describe the clinical types: "forme quadriplegique, forme hemiplegique, etc." In these cases the motor and sensory functions are usually re-established in the course of a few weeks, tho permanent loss may remain. The cerebro-spinal fluid is clear, containing no blocd or excess cellular elements. This is an exceedingly important point in differential diagnosis.

Hematomyelia, another cord condition coming under this heading, consists of hemorrhage into the grey matter of the cord. This may occur incident to a crushing injury of the cord, but usually as a focal lesion. It occurs usually in the cervical region, due to a fall on the head, the neck in acute flexion. Here the cord is more vascular and the connective tissue framework less dense, allowing the effusion to extend up and down through grey matter rather than outwards into the more resistant white matter. The clinical picture produced is that of flaccid paralysis of upper limbs, due to hemorrhage into the anterior cornua, and spastic paralysis of lower limbs caused by pressure on the lateral cortico-spinal motor tracts. The sensory disturbances consist of anesthesia to thermal and pain sense without impairment of the sense of touch. The paralysis subsides early, but weakness remains.

II. Injury to Vertebral Column without Injury to Spinal Cord.

The danger in this condition is that a rarefying osteitis may follow, causing kyphosis and pressure on the spinal cord (Kummel's disease), evidenced often by weakness in both upper and lower extremities. Laminectomy usually relieves.

III. Injury to Both Spinal Cord and Vertebral Column.

Prior to the war Horsley and others advocated early operation on these injuries in all doubtful cases. The result was not encouraging, and caused many surgeons to take a conservative view. The extent and nature of the lesions (Holmes) are:

1. The cord, when divided, has a considerable amount of clot and bone fragments between the ends.

2. In injuries of lesser intensity there is disintegration of a portion of cord, and a semi-fluid or custard-like material escapes on pricking the pia. Cross section may be blurred.

3. If injury be slight, the normal structure is only obscured and there may be slight hemorrhages. Subdural hemorrhages of considerable size may occur, but rarely large enough to compress the cord. (Interesting.)

4. Secondary degenerative changes in the neighborhood of the primary occur. Edema, though present, is not of inflammatory type. Affects the neurological matrix as well as nerve cells.

5. Distinct lesions may be found extending for four or five segments above and below the site of injury. These include edema, small hemorrhages, swelling of axis cylinders, focal necroses, and formation of cavities.

Walton pointed out that injury to cord was a result of momentum of the body, and caused at moment of injury. It must not be confused with con-

tinuous pressure exerted by depressed bone, if also present. Any increase in destruction of cord, due to irritation around, or pressure of a foreign body or depressed bone, will appear after an interval. It is therefore not essential to remove pressure at once. (Interesting.)

Many cases are reported where dura has not been perforated by depressed bone, yet after removal of latter permanent paraplegia remains, because the force of primary impact was sufficient to destroy cord. When the signs indicate complete lesion, operation is contra-indicated. If partial lesion, with possible continued pressure on cord, operation is indicated. If, in the case of partial lesion, there is no evidence of improvement, operation is indicated. In all cases, operation should be delayed until able to differentiate between partial and complete lesion.

Riddoch has grouped into three stages the clinical signs indicating complete and incomplete lesions:

Stage I. There is at first a period of flaccid paralysis with hypotonia, complete sensory loss and abolition of all reflexes, except that tonic contraction of the bladder and rectal sphincters persists. This stage lasts for a variable period, usually from one to three weeks.

Stage II. (a) In complete lesions: Reflexes, many of them complicated and showing adaptation to an end, can be evoked from an increasing reflexogenous area by a decreasing stimulus. These reflexes are flexor in type and overflow into other reflex arcs, so that soon a small stimulus causes an extensive response. To this phenomenon the name "mass reflex" is applied. This comprises flexor spasm of the abdominal wall and both lower extremities, evacuation of the bladder when its contents are half the amount at which it would otherwise empty itself, and sweating from an area of skin varying with the level of the lesion. At a later date knee and ankle jerks can be elicited, but these are not well sustained.

(b) In partial lesions: In this group extensor or static reflexes return at the same time as the flexor. The reflexogenous area is much more limited. Local signature is present—there is not the same wide spread of the reflex. The knee and ankle jerks return earlier and are well sustained. Extension of the contra-lateral limb may occur, simulating a movement of progression. An extensor thrust may be elicited by pushing up the distal portion of the sole of the foot.

Stage III. In the presence of septic complications, the reflex activity disappears and the limbs pass again into a state of flaccidity.

Milder cases of spinal injury are more obviously incomplete. In cases I and II, for example, there was not a total sensory loss, the clinical picture being that of a Brown Sequard syndrome.

In order to determine the type of vertebral injury, radiographic examination should be carried out in all cases of this nature. I wish to emphasize the importance in thoracic lesions of taking the x-ray picture in an oblique position, so that the shadow of the vertical bodies is thrown in front of that of the spinal arches. In cervical and lumbar injuries a lateral view can be taken. It requires the eye of faith to detect a depressed fracture of the laminae in an antero-posterior view of the spine.

No results are more satisfactory than those following a successful laminectomy for the removal of pressure upon the cord, but the indiscriminate exploration of these injuries is calculated to bring this operation into undeserved disrepute.

Lesions of the Cauda Equina

Here operation should not be delayed. It is not yet definitely determined whether regeneration can occur in the nerve roots, but I know of one case in which a regeneration neuroma was found upon the central end of a divided root. This supports the belief that, where possible, the roots should be sutured as soon as possible.

Care of the Bladder in Spinal Lesions

Gaskell and Langley have proved that the bladder receives a double nerve supply from the hypogastric nerves (from the thoraco-lumbar autonomic system) and the pelvic nerves (from the sacral outflow). Both nerves contain afferent and efferent fibres. The preganglionic fibres of the thoraco-lumbar supply to the bladder form synapses around ganglionic cells in the inferior mesenteric ganglia. The ganglion cells of the sacral outflow are actually in the wall of the bladder in the hypogastric plexus.

These two nerve supplies are functionally antagonistic to each other. The pelvic nerves carry impulses causing contraction of the detrusor mechanism and inhibition of the sphincter mechanism of the bladder. The hypogastric nerves, on the other hand, initiate and maintain a contraction of the sphincter musculature and, in some animals, inhibition of the detrusor musculature. The latter action probably does not occur in man.

There are three centres controlling this nerve supply. These are situated in the peripheral ganglia, the spinal cord and the cerebrum. The central nervous system integrates afferent and efferent impulses from the bladder and maintains the static tone of the organ. The wall of the bladder is thus held in a state of constant postural contraction, gripping its contents lightly, whether the amount be large or small. When the cubical content of the bladder reaches a certain amount, reflex emptying takes place. Rythmical contractions of the detrusor musculature increase in amplitude with increasing distension. Afferent impulses are thereby increased and lead to a discharge of pressor impulses by the pelvic nerves to the muscle of the bladder wall and inhibitor impulses to the sphincter musculature, thus emptying the bladder.

In cord lesions two distinct stages are observed:

Stage I. Complete retention: There is active contraction of the bladder sphincter. Feeble contractions of the detrusor musculature occur, but are insufficient to overcome the sphincteric resistance. When the bladder becomes very distended, overflow incontinence results, small amounts of urine dribbling constantly from the meatus.

Stage II. Reflex micturition: In this stage the bladder empties reflexly when its contents reach a certain set capacity. This is the permanent state in severe cord injury. If cystitis be present, the bladder contracts very much and may have a capacity as low as 30 to 60 cu. There is a transition period

between these two stages during which contraction of the detrusor mechanism can expel a small portion of the bladder content.

The condition of flaccidity of the bladder and sphincter, resulting in paralytic incontinence, was not present in any of the cases. This condition was present in and characteristic of a lesion of the lumbar cord or cauda equina.

The problem that concerns us is how to prevent urinary infection during the first stage before the commencement of reflex micturition, i. e., to give the patient a clean automatic bladder.

The first essential is to prevent distension of the bladder. It has been found experimentally in animals that if the bladder distension is not relieved, hemorrhage and ulceration occur in the bladder wall. Distension of the bladder also delays the onset of reflex emptying and may give rise to atony or cystitis and fibrosis.

Four methods of treatment are advised: (1) Catheterization; (2) The tied-in catheter; (3) Manual expression; (4) Supra-pubic cystotomy (a) primary, (b) secondary.

Operative Technique

The author directs special attention to the value of local anesthesia in the operation of laminectomy.

The best method of opening the spinal canal is to make a burr opening through the apex of the spinal arch after removal of the spinous process and to enlarge this opening with a small parrot-bill rongeur. In this way it is easy to avoid any additional injury to the cord; and the time spent in removing the laminae is reduced to a minimum.—*J. E. M. Thomson, Lincoln.*

Concerning the Question of Acute Atrophy of Bone in Fractures. R. Lenk. *Fortschritte aus d. Geb. der Roentgenstrahlen.* Band XXVI. 1919, Heft 4/5.

In a very lengthy discussion concerning acute bone atrophy in fractures of bone, the author arrives at the following conclusions:

1. Acute bone atrophy is a usual occurrence in fractures of bone.

2. Its appearance is noticeable in the radiogram not later than three and a half weeks after the injury.

3. It becomes localised usually, independent of the site of fracture, in all the joints of the injured extremity; in rare cases the atrophy is more pronounced in the joints nearest to the site of fracture.

4. Inactivity is the greatest factor in its production; only in rare instances may other causes be contributing.

5. The acute bone atrophy is not the cause for delay in callus formation.

6. Its prevention can only be attained by the avoidance of inactivity and early mobilisation.—*A. Gottlieb, San Francisco, Calif.*

INFECTIONS OF BONES AND JOINTS. F. J. Cotton. *Surg., Gynec., and Obst.*, 1920 254-262.

This paper is a general review of the subject of infections of bones and joints and gives the ideas of the author as to treatment in such conditions.

In the future the not unusual cases of chronic wound sinuses should be rare. Primary wide debridement has little place in civil surgery. There is no advantage in doing more in cases of osteomyelitis than making a wide open exposure. Remove no bone early when there is infection, but insure wide-open drainage, disinfect, and wait for demarcation.

Cotton emphasizes the points that army splints are meant for use in transportation and that even the Thomas splint must be used skilfully. He mentions the frequency with which war wounds flare up when opened because of non-union, even after they have been healed for a long time. The lack of bone salts in cases of non-union may be overcome by a substance such as magnesium. Cotton is now trying the injection of insoluble lime salts in these cases and suggests that, if this treatment fail, urine salts may be of some avail.

There is usually a three day interval between fever and pain and necrosis. If early exploration is made and the pus evacuated; treatment may be continued in the following manner: (1) drain well, (2) wait for demarcation, (3) wait for involucrum, and (4) use Dakin's solution.

The author obtains more satisfactory results with fat transplants with pedicles than with muscle, and uses bone wax, not expecting it to stay permanently but to be extruded gradually.

In fresh cases of infected joints Cotton washes the lesion with 1-15,000 solution of bichloride of mercury and sutures the capsule tight leaving the wound open. In more serious cases the joint should be laid wide open and disinfected with Dakin's solution.—*M. S. Henderson, Rochester, Minn.*

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CONGENITAL MALFORMATIONS AND DEFORMITIES OF THE HAND

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In the terms of primary variation or abnormal pressure, of intrinsic developmental error or extrinsic amniotic influences, are embodied two principal and antagonistic theories on the origin of congenital malformations in general, and those of the hand in particular. To these have, in the course of time, been added a number of other views for the benefit of special cases or of special groups of cases; observation and reports of the last two decades, however, brought little decision and the strife is still on.

Upon the basis of primary developmental aberrations Gegenbauer formulated his Archi-pterygial theory. The primitive first ray embraces the radius, scaphoid, trapezium, first metacarpal and thumb.

The amniotic theory of Schwalbe, Dareste and others is on the other hand, becoming increasingly difficult to maintain for many reasons, some of which will be set forth in the course of this paper. Dareste sees in it the explanation of such deformities as hemimelia phocomelia, ectromelia, etc. Some deformities are undoubtedly due to amniotic pressure, especially if one considers that such pressure may be responsible not only for congenital constrictions and amputations but also for actual inhibition of development and differentiation of the skeleton during the stage of scleroblastemic formation.

The assumption, however, that amniotic bands and adhesions may account for bi-lateral and symmetrical deformities is open to gravest objections and the instances where the amniotic theory seems applicable form an ever decreasing minority. (Gaenslen.)

Aside from this there still exists a number of cases in which other etiological factors ought to be considered. Some may be ex-

plained upon a neuro-genetic basis as developed by Duchenne and Schulthess, and others. They are classified as myèlo-displastic deformities.

Duncker, in discussing congenital Claw Foot and kindred deformities calls attention to spinal maldevelopment, rachischisis or indications of spina bifida occulta. The analogy of such cases with deformities of the upper extremities accompanied by malformation of the spine or thorax, as we have had occasion to observe, is obvious.

There are, finally, numerous cases of skeletal malformation of all kinds, which present the clinical syndrome of polyglandular disturbances, especially functional anomalies of the hypophysis. Such instances will be referred to in the proper chapters.

Heredity and familial tendencies are found more or less prominent in many if not in all deformities of the hand. They form a back ground to the several types of mechanisms by which development of deformities is accomplished.

I venture to suggest as a workable scheme, based upon clinical rather than etiological features, the following classifications:

CLINICAL CLASSIFICATIONS

A. Deformities by developmental suppression, agenesis:
   1. Congenital Defect of the Forearm Bones.
   2. Lobster Claw Hand.
   3. Ectro-dactyly (A-phalangism).
   4. Hemimelia.

B. By Developmental Arrest.
   1. Syndactyly.
   2. Sym-phalangism.

C. By developmental aberrations.
   1. Polydactyly (Some cases).
   2. Hyper-phalangism.

D. Dysplastic Conditions.
   1. Chondro-dystrophy.
   2. Brachy-dactyly (some cases).
   3. Fusion of carpal bones.

E. Polyglandular Dystrophy.
   1. Polydactyly (some cases).
   2. Macro-dactyly.
   3. Arachno-dactyly (partial gigantism).

F. Contractures (Neurogenetic or amniotic).
   1. Contracted Club Hand.
   2. Contracted fingers.
   3. Amniotic contractures (non symetrical).

One does not gain the impression from the study of the literature on the subject that a decision has been gained in favor of one or the other of the principal doctrines on congenital malformation. Much of this is due to the very frequent and perplexing complications found in cases of malformations. Such combination as polydactyly and syndactyly, congenital defects of the forearm bones and syndactyly, ectrodactyly and syndactyly for instance are not at all exceptional and naturally complicate the application of any one of the theories to a given case. Many more investigations of anatomical and embryological type will be necessary before any amount of clearness will be brought into etiological questions concerning malformation of the hand.

Our series of 25 cases of malformation of the hand represents one half of 1 % of all the Orthopaedic conditions seen within a period of ten years. It is entirely in line with other contributions in the literature in as much as it cannot claim to bring out any further decisive points in favor of one or the other of the principle genetic theories. But I think that a number of cases can be shown in which peripheral deformity is complicated by central anomolies either of the spine or other structures, of a character which dates the origin of the deformity back into earlier embryonal life and is naturally at variance with the assumption of extrinsic mechanical influences.

1. Congenital Club Hand

According to Archipterygial theory of Gegenbauer the deformity comes about by suppression in the development of the first ray, including radius, scaphoid, trapezium, 1st metacarpal and thumb or, more rarely by suppression of other primitive rays of the hand. The regularity of the defect and frequent symmetry makes an explanation by mechanical causes such as pressure of the uterine wall or amniotic constricture very difficult. The radius being developmentally behind the ulna a deformity by inhibition of growth of the former can be readily understood. This explains also the preponderance of the radial club hand over the ulnar. (Keibel and Moll.)

Up to 1904 Kirmission reported 67 cases of which 57 showed total and 10 partial bone defect. Up to that time only 13 cases of congenital defect of the ulna were collected according to Blencke.

McCurdy in 1906 reported 45 cases, Antionelli 114 cases with total or partial defect of the radius, while Whitman in 1912 found over 200 cases in the literature. Observations of congenital absence of the ulna are very much more in the minority. Blencke (1904) refers to a family of nine of which four showed this deformity.

Bi-lateral defects are as frequent as uni-lateral. Complication with other deformities are frequently seen. Of 57 cases collected by Rosencratz 35 cases were complicated by congenital club feet. (Haudek.)

Blencke's cases of congenital defect of the radius also showed complications with club feet. Combination of complete bi-lateral absence of the radius with apparent absence of all bones of the carpus is reported by Dareste. Other instances of combination with congenital club foot are cited by W. Taylor and Wirth.

There have been further observations of interesting combinations of congenital defect of the radius and thumb, with deformities of the thorax. In Dorner's case there was fusion of the ribs of the 6th, 7th and 8th being united by bony bridges.

Kirmisson, dissecting one case of total defect of the radius with absence of the thumb found the thumb muscles and muscles of the radial side missing, also the long head of the biceps. He found an abnormal muscle bundle running obliquely across the elbow in front, which he could not identify. In the ulnar club hand the defect on the ulnar side involves the ulna and one or two of the metacarpals and fingers. In the cases described by Roth the lower half of the ulna was missing and only two digits existed. A case with defect of the 3rd, 4th and 5th fingers and total defect of the ulna is reported by Neumann. This was complicated by a web running from humerus to the forearm and limiting extension of the elbow to 45 degrees. Ehrenfried's case is one of shortening of the distal end of the ulna on the basis of chondro-dysplasia. Anatomical data on ulnar club hand deformity are very meager. Watt found bi-lateral congenital absence of the ulna in a fetus with mono-dactyly, an additional finger being attached to the elbow with a web binding the forearm to the humerus. He found the superficial extensor group of the forearm present, the deep group

missing; the forearm flexors were present tho badly disorganized. In the hand only one muscle was present, a lumbrical, arising from the lateral side of the tendon of the flexor pollicis. Of the nerves of the hand the median was seen giving off cutaneous branches to each side of the finger. The ulna ended subcutaneously on the median border of the forearm. Corresponding anomalies were found in the arterial supply.

Kirmisson found dislocation of the head of the radius with defect of the lower end of the ulna in a case of ulnar club hand. In his case three fingers were fully developed, the thumb, a completely fused index and middle finger, forming one large finger, and the little finger. The ring finger was totally missing.

Of considerable interest are those cases of congenital club hand which are not associated with bone defect. Here again it is hard to see, how the amniotic theory can hold in the face of the bilaterality and symmetry of the deformity. These contracted club hands are by some considered as club hands in the stricter sense of the word because of their analogy with congenital club feet. According to Tubby their occurrence is rare. They are classified as ulnar, palmar, radio palmar, ulno dorsal and radia dorsal club hands, according to deviation.

The club hand deformity is corrected by tenotomy in minor cases or by osteotomy according to Hoffa; by excision and reimplanting of the ulna in to the carpus (Sayre) ; by longitudinal splitting of the ulna and implantation of the carpus between two halves, according to Bardenheuer; by severing of ulna at a point nearest to the proximal edge of the carpus and implantation of the ulna into carpus according to McCurdy, or by longitudinal splitting of

FIG. 1—CASE 1—Congenital defect of radius.

the ulna, up to the cubital end, separating of the halves by muscle tissue and manual correction of the deformity according to Antonelli. (Rincheval, Lizabue).

Vulpius used periosteal flaps from the ulna together with correction of the deformity. Good results are obtained by Albee who implants a tibial graft obliquely into carpus distally and into the ulna proximally.

Our series of club hand covers ten cases of which four are congenital deformities with bone defects and six contracted club hands. Two cases show congenital absence of the radius.

1. K. M. 5 mo. Right angle deviation to the radial side, complete absence of the radius, the thumb and its metacarpal. Motion is normal, the deformity bi-lateral and symmetrical. This case was treated by osteotomy of the ulna.

FIG. 2—CASE 1—Congenital absence of radius.

2. R. G. 8 yrs. Radial abduction of the hand to 130 degrees with rudimentary thumb, and a small rudiment of the first metacarpal. Defect of the entire lower end of the radius.

The deformity was treated by removal of a piece of the elongated ulna, correction of the deformity and formation of a new thumb by means of a piece of the 7th rib implanted in the first metacarpal and covered with skin flap by the two stage Italian flap method. No history of heredity.

FIG. 3—CASE 2—Congenital defect of radius.

FIG. 4—CASE 2—Congenital defect of radius. Constriction of thumb.

FIG. 5—CASE 2—Congenital defect of radius. Constriction of thumb.

The following two cases represent instances of congenital club hands with defect of the ulna.

3. J. E. K. 17 yrs. Both hands in ulnar abduction with curving of the radius and absence of the lower end of the ulna. Of the carpal bones seven were present, all of the distal and only three of the proximal row. The deformity is bi-lateral symmetrical and complicated by bi-lateral congenital club feet with defect of the fibula. This case was not treated as function of the hand was very good.

4. H. P. 4 yrs. Ulnar deviation of the left hand at right angle. Complete absence of the ulna. The deformity is asymmetrical and uni-lateral. Motion normal. Complicated by syndactyly consisting in webbing of the 3rd, 4th and 5th fingers. No fingers missing.

Deformity was corrected by osteotomy of the radius and operation for syndactyly of the fingers. No heredity features.

Fig. 6—Case 4—Congenital defect of radius.

The following cases represent the group of contracted club hand without bone defect.

5. C. M. 11 mo. Twin child. Followed by another set of twins one of which was born with club feet. The patient's twin sister is normal.

According to the mother's statement the chord was, at birth, twisted around the body. The patient shows contracted palmar club hands in flexion of 25 degrees; the deformity is bi-lateral and symmetrical without bone defect. The condition is complicated by contracture of the elbows, by adduction contracture of the shoulders, by flexion contracture of the hips, flexion contracture of the knees and congenital club feet; also by Cryptorchism, high palate and strabismus. Pending the correction of the congenital club feet operative correction of the club hands was deferred and treatment carried out with adjustable splints.

6. A. B. 10 yrs. Bi-lateral, ulno-palmar contracted club hand without bone defect. Motion is restricted in wrist and fingers in direction of extension and the thumb is fixed in adduction and opposition. The deformity is complicated by flexion contracture of the elbows, by extreme flexion of the knees and bi-lateral club

Fig. 7—Case 6—Contracted club hands.

feet. This deformity is also treated conservatively pending the correction of the club feet and flexion contracture of the knees.

7. P. T. 7 yrs. Palmar contracted club hand, right, without bone involvement. Muscles of the thenar are atrophic. Complicated by contracture of the elbow, extension being limited to 140 degrees, atrophy of triceps, rhomboids and deltoid muscles without evidence of paralysis. No contracture of the shoulder. The deformity is treated by tenoplasty of wrist and fingers and arthrodesis of the wrist. Immediate result is good, both functional and cosmetic.

8. G. H. 6 yrs. Palmar contracted club hand bi-lateral symmetrical. There is a little restriction of motion. The deformity is complicated by flexion contractures of the elbow, by adduction contracture of the shoulder, by contracture of flexion of the hips of the knees and by contracted equino valgus deformity. It is further complicated by high palate, speech defect, malformation of the jaw and by congenital scoliosis with formation of wedge vertebrae.

Fig. 8—Case 8—Congenital contracted club hands.

This deformity was not treated in view of the good function of the hand and fingers.

9. E. T. 6 mo. Ulno palmar contraction of both hands. Bi-lateral symmetrical deformity without bone defect. There is restriction of extension and radial abduction of the wrist. The deformity is complicated by syndactylism of the 2nd, 3rd and 4th fingers of the left hand, by flexion deformity of the knees and by flexion deformity of the hips, by extension contracture of both el-

bows and by congenital club feet. The club feet are corrected operatively. Pending this, the treatment of the wrist is carried on conservatively by adjustable splints.

10. F. C. 6 mo. Ulnopalmar contracted club hands, bilateral symmetrical deformity. No involvement of bone, good motion. The deformity is complicated by congenital absence of both patellae and genua recurvata.

FIG. 9—CASE 8—Congenital contracted club hand.

This case also treated conservatively by splints pending the operative correction of the genua recurvata.

In none of the ten cases the club hand deformity as such was hereditary, with exception of case 9 where the deformity of the hands existed in a second cousin. The occurrence of the congenital deformities, however, in the other members of the family was noted in several instances. Special attention is called to the various complicating deformities in the cases of contracted club hands.

Fig. 10—Case 9—Congenital contracted club hands.

Fig. 11—Case 10—Congenital contracted club hand.

Cleft Hand

The hereditary tendency of this deformity is illustrated by a report of Tubby of a case of cleft hand, the deformity extending thru five generations and being associated with cleft feet. Cases of split feet accompanied by Lobster Claw Hand deformity are also reported by McKnight and Brandenburg. Bradley's case of congenital cleft hand deformity is also associated with deformity of the foot. Of four cases reported by Bircher two showed hereditary tendencies involving mother and daughter. There was a combination with polydatyly and spina bifida in one case and synostosis and syndactyly in the other case. Combination of hyper-dactyly and brachy-dactyly with metacarpal fusion and bifurcation was observed in two more cases reported by the same author.

Case Report—11. R. B. 9 yrs. No family history obtainable. Right hand shows fully developed thumb and index finger on the radial side and fully developed little finger on the ulnar side. Between these there is a deep cleft reaching to the carpus. The left hand shows radially thumb and index finger with syndactyly of these two fingers; on the ulnar side there is a fully developed little finger and between these is a deep cleft reaching to the carpus. Thenar and hypothenar muscles appeared to be fully developed and there is excellent motion of the fingers except for the lack of opposition of the thumb. The feet show similar cleft. On the right hand there is a cleft between first and fourth toes, second and third toes missing. The cleft reaches to the tarsus. On the left foot

Fig. 12—Case 11—Lobster claw hand.

there is a cleft between the 1st and 5th toes, 2nd, 3rd and 4th toes missing. The cleft also reaches to the tarsus.

The clefts of the feet were united by operation. The clefts of the hands not operated owing to good function of the hand.

Syndactyly

Different genetic theories are being advanced in connection with this type of deformity; external pressure or amniotic bands (Dareste), central neurogenetic influences, primary developmental variations or reversion to early type have been considered. A division should be made into primary developmental and external pressure form of syndactyly. Tubby divides the cases of syndactyly into (1) Finger webs (cutaneous syndactyly) (2) skin and fibrous connection tissue webs, (3) bony union with fusion. Kirmisson, too, speaks of a web type (syndactylie membraneuse). Some cases are associated with brachy-dactyly. As regards the bony fusion it must be considered that apparent fusion does not always mean a true fusion of phalanges and metacarpals. While identity of the fingers can usually be established even in apparently complete fusion there are cases reported where apparently completely fused giant fingers are formed with one small nail. In such cases the X-ray showed complete skeletal separation of the two fingers. (Nove-Josserand.)

Partial fusion of the fingers and metacarpals is by no means uncommon (Bailleul). There are cases in which the fusion concerns only the proximal half of the phalanx. This might give the distal part the appearance of bifurcation such as seen in polydactyly. Some cases of syndactyly are associated with a-phalangism, i. e. lack of one or the other of the phalanges (Lewis). There is another type in which fusion concerns the distal part of the fingers the bases being more or less free (Acro-syndactyly).

Combinations with other deformities are not exceptional. Syndactyly is seen to associate with cleft hand, club hand or polydactyly. Combination with acrocephaly has been noted by several observers (Ruh, Davis, Bertolotti).

Some anatomical data are at hand from observations of Klippel and Rabaud. They found the superficial palmar arch to descend as far distally as to reach the proximal phalanges; the bifurcation from this arch of collateral arteries was therefore, much

more peripheral than normal. There were also anomalies in insertion and course of the tendons. Syndactyly has a strong hereditary tendency. Luaces reports a syndactylic family of 39 with 14 syndactylous members, the deformity in some instances skipping one generation. There are many other reports of hereditary and familial cases of syndactyly, too numerous to mention.

For the correction of the deformity many operative methods have been devised. Zellers method consists in longitudinal splitting of the web with a triangular flap to cover the base. Tubby tunnels the fingers by a flap method from both sides and deals with the web after the canal has been completely established. Didot's operation, which is most widely used consists in trap door incisions on the volar and palmar sides with lateral bases, the free ends being brought around to cover the raw surfaces of the separated finger. A modification of this is Forge's method who, besides the dorsal and volar flaps, uses a flap from the dorsum of the hand. Spitzy thins out the web by means of prisms contained in a small contrivance and pressing against the line of fusion. The web is divided later by clipping.

Report of Cases

12. E. A. 4 mo. Bi-lateral symmetrical deformity. Acrosyndactyly. Bone fusion. All fingers of the hands were fused at the tips, complete webbing. Operative treatment, Didot's method.

13. W. F. 7 weeks. Syndactyly of the right hand between index and middle finger, tips fused. On the left hand the end pha-

FIG. 13—CASE 13—Acro syndactylism.

langes are fused on all fingers including thumb. Acro-syndactyly. The X-ray shows fusion of the tips of the end phalanges of all fingers mentioned.

This case is complicated by syndactyly of the toes of the right foot. The case was treated by plastic operation, Didot's method being used mainly. The operative result was good. On the left hand, which was badly fused, four fingers were obtained, 1st, 2nd, 3rd and 4th.

14. B. S. 3 yrs. Incomplete syndactyly on both hands. Incomplete webbing, bi-lateral and symmetrical. No bony fusion. This case is one of cutaneous syndactyly, complicated by ankylosis of middle phalangeal joint of the 4th finger. (Symphalangism). Not operated.

15. G. C. $4\frac{1}{2}$ mo. The deformity is bi-lateral and symmetrical the web reaching to the end phalanges of the 2nd, 3rd, 4th and 5th fingers. (Cutaneous syndactyly). There are no bone changes but there is limitation of motion in metacarpo phalangeal joints. This case is complicated by syndactyly of the toes.

Fig. 14—Case 16—Acro-Syndactyly.

16. F. W. 11 yrs. Bi-lateral syndactyly with fusion of the 3rd, 4th and 5th fingers. The deformity involves more the distal parts of the fingers; the nails are completely fused. (Acro-syndactyly). The feet show a syndactylous condition of the 3rd and 4th toes of the web type. The X-rays of the hands show incomplete skeletal separation of the phalanges. The case is treated by flap method. (Didot).

17. R. J. 5 mo. Cutaneous, bi-lateral syndactyly of thumb and index fingers preventing abduction of the thumb. No bone deformity. Not operated. This case approaches closely the group of congenital contractures of the fingers.

FIG. 15—CASE 14—After operation.

18. T. L. 16 years. Bi-lateral syndactyly. One brother had 3 fingers missing at birth. On the left hand the second, third and fourth fingers show fusion from tip to base of proximal phlanges. The nails are not fused. There is no bone fusion. On the right

FIG. 16—CASE 18—Syndactyly.

hand the second and third fingers are fused as far as the end of the proximal phlanges. The third and fourth fingers are fused from tip to base. The nails are not joined. Left foot shows syndactyly of the second, third and fourth toes from tip to base, the

right foot of the second and third of the distal end to the proximal phalanges of the third and fourth from tip to base. This is a case of syndactyly complete in all fingers but without skeletal fusion, or fusion of the nails. The history shows hereditary tendency. Case was operated by Didot's method. Good result.

FIG. 17—CASE 18—Operated.

19. M. J. 2½ years old. One other syndactylous child. Mother's brother has syndactylic ring and middle finger on the right hand. This case is one of cutaneous syndactyly of third and fourth fingers of the right hand. The case was operated by the trap door method with good result.

FIG. 18—CASE 19—Syndactyly. Operated.

Of the eight cases of syndactyly reported only two show hereditary data. Two cases may be classified as acrosyndactyly, the fusion being most marked at the tips. Web fingers or cutaneous syndactyly was present in three cases. Two cases show more or less complete syndactyly without skeletal fusion, the fusion extending from tip to base of the fingers. The case of web between thumb and index finger resembles more the types of congenital contractures than those of syndactyly.

Sym-phalangism.

Sym-phalangism or fusion of the inter phalangeal joint is an extremely rare condition. Rimbaud considers his case of bone fusion of the phalangeal joints of the second to fifth fingers as entirely unique in the literature; partial fusion, however, is occasionally reported. Goldflam mentions 26 in three generations of total of 46 members. Complete ankylosis is also reported by Freund and Cushing. We have observed only one case of congenital bi-lateral sym-phalangism of the fifth toes.

Aphalangism.

The absence of the phalanges is a condition of distinctly hereditary tendency. Cragg and Drinkwater report a family tree of five generations with 25 abnormal and 17 normal members. The deformities were divided between brachy-dactyly and entire absence of phalanges. The hereditary tendency of absence of digital parts is also corroborated by the reports of Clark and others. The defect concerns mostly the terminal phalanges, sometimes the middle phalanges. Farther reaching defects of fingers which include the basal phalanges lean more toward the group of ectro-dactylism or total absence of fingers.

This group is considered to be one of the best illustrations of amniotic amputation; but here also the bi-laterality of the process in many cases makes this explanation difficult. Cases of congenital defect of the phalanges are also reported by Neil, Crawford and Chesser.

Case Report—E. E. 10 yrs. Congenital lack of the end phalanx of the index finger. Bi-lateral. The deformity is complicated with cleft palate and congenital club foot.

Ectrodactyly or congenital absence of entire fingers differs only in degree from the foregoing group. In uni-lateral cases fetal amniotic amputations may be considered as the cause. In other cases abnormal osteogenesis and in some central nervous disturbances may be responsible. The defect may be marginal or central (Tubby). Klipple and Rabaud who report four cases of total ectrodactyly distinguish between ectrodactylie phalangienne, the fingers being represented only by small stumps in which osseous nodules may be noted articulating with the metacarpals; and ectrodactylie metacarpo-phalangienne, in which the metacarpals are missing as well as the fingers. To this collection reports are added by Lewin of a case with 3rd and 4th fingers missing, and by Judet who describes a case of total ectrodactyly of all fingers with only three carpals being present. The latter case represents a transition to ectromelia. Combination of ectrodactyly with polydactyly is reported by Atwood and one with syndactyly by Luaces.

Polydactyly may be of the central or marginal type and may be caused by bifurcation over metacarpal joints or by branching off from metacarpals or phalanges themselves (syndactylic forms).

The marginal form is by far more frequent (Tubby). Leedorf mentions that in 15,000 new born children only 10 show polydactyly, but heredity is quite pronounced as seen by reports of Benard covering five generations of polydactyly. In Brandeis series of a hexadactylous family, in the polydactylous family of Atwood, heredity is also a prominent feature.

Moore reports a family of seven generations of polydactyly with 20 cases among 237 individuals. Amrein, quoted by Brandenburg, reports seven sisters with hexadactyly. According to Danforth's investigations on supernumerary fingers, these contain a cartilaginous core not attached to the other bones of the hand. He found the abductor digiti minimi sending slips into supernumerary digits attached to the little finger. On the volar side the extra fingers received a branch from the proper digital nerve to the ulnar side. The extra digits were found to present the element of a normal finger in a shortened and more or less abortive condition (early period of ontogeny). Complicating deformity is not uncommon in cases of polydactyly. (Cantley). Combination with syndactyly is reported by Fontes, and Klippel and Roebaud report a rare combination of a case of polydactyly by metatarsal bifurcation with syndactyly of the middle and terminal phalanges. Of

great interest are the observations of polyglandular syndrome in cases of polydactyly. Fontes and Magaloes describe such cases of polydactyly with obesity, genital hypoplasia, and a similar observation is made by Bertolotti.

Retinitis pigmentosa and coloboma of the iris were observed in connection with polydactyly (Daries) and in general the reports on disturbance of function of endocrine glands in polydactyly are becoming numerous enough to claim some relation to this and similar deformities of the hand.

Case Reports

21. R. H. 7 mo. Deformity of the left foot. Polydactyly by bifurcation of the end phalanx of the 5th toe.

22. J. C. Polydactyly of the thumb. Double thumb with double end phalanx. The accessory thumb had been removed prior to observation but the basal phalanx of the duplicated thumb

Fig. 19—Case 22—Polydactyly.

was still left, leaving a lateral deformity of the end phalanx of the original thumb. Both the secondary and the proximal phalanx could be seen distinctly, there was no fusion. No other deformity. Treated by plastic operation.

Hyperphalangism. The phalanges differentiate in serial order, the basal one appearing first and the terminal one last. According to Graefenberg the terminal phalanges show evidence of

being composed of two elements, a proximal and a distal one. The distal one, failing to unite with the proximal may represent the 4th phalanx. Primitive digits were probably composed of many phalanges. Hyperphalangism therefore can be explained upon the basis of developmental arrest as failure of fusion of the two halves of the terminal phalanx.

Hyperphalangism is rare. Cases are reported by Hilgenreiner, Joachimsthal, Reynolds and others. Reynolds describes a case in which the thumb has the appearance of the 5th finger, the terminal phalanx being shaped so nearly like that of the digit. The thenar eminence was absent. In two cases of Joachimsthal the index fingers had four phalanges each and in a third case there was hyperphalangism of the 3rd finger. He also found evidence of heredity in hyperphalangism.

The X-ray shows distinct deviation from normal type of ossification. The distal end of basal phalanx of all fingers in Joachimsthal's case showed an epiphysis (distal ossification center). Seven cases of three jointed thumbs were reported by Pitzner who found that the middle phalanx was the supernumerary one as it had neither distinct epiphysis nor articular surfaces. Freund reported a case with an epiphysis of the middle phalanx on both ends. Slight deviation of the fingers with accessory phalanges are also reported by Roederer, by Dubreuil, Chambardel. In the case of the latter author there was a distinct joint dividing second metacarpal into two unequal parts so that the supernumerary link seemed to be given off by the metacarpals instead of the phalanx.

Arachnodactyly was first brought to attention by Marfan in 1890, who called the deformity dolicho-steno-melie. Since then cases have been reported by Achard, Thomas, Dubois, and others. The condition is essentially one of abnormal length and thinness of the fingers, resembling spider legs. Borger describes two cases; in both the deformity was bi-lateral on fingers and toes. Slight degenerative changes were seen in one case such as hydrocephalus. A case coming to autopsy showed flattened epiphysis, fatty bone marrow and scarcity of trabeculae and osteoblasts. These findings, also, seem to indicate involvement of endocrine gland. For this reason the last named author considers arachnodactyly as a form of partial gigantism based upon defective development and possibly early exhaustion (intrauterine) of endocrine glands.

Congenital Contractures. Amniotic Furrowing.

To a number of cases the amniotic theory is doubtless applicable. Such cases are characterized by amniotic grooves, amputations, partial or complete, of fingers or limbs. They are asymmetrical and uni-lateral.

Case Reports—23. L. T. 2 yrs. Shows amniotic furrows and grooves of the index, 3rd and 4th fingers of the left hand. Motion of the index finger is slightly restricted otherwise normal function. The case is complicated by spontaneous amputation of right leg in lower third of tibia, absence of the 2nd phalanx of 2nd toe left foot. No other signs of degeneration or deformity. Amniotic scars and groove leave no doubt as to the origin of this deformity.

Fig. 20—Case 23.—Amniotic Constrictions.

The deformity was treated by application of an artificial limb to the stump of right leg, and by plastic operation of the constricted fingers.

Congenital contracture of the fingers, whether due to amniotic constrictions or primary developmental errors, are not frequent. Some of these have already been described under the heading of contracted club hand without bone deformity (Tubby). Finger contractures have been seen in connection with cleft hand or club hand. Hereditary tendency exists in the cases of Gassul, who reports on congenital contractures of the 4th and 5th fingers, sym-

Fig. 21—Case 23—Amniotic Constrictions. Operated.

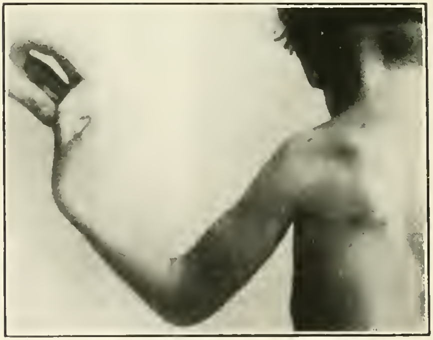

Fig. 22—Case 25—Congenital contracture of hand. High scapula. Congenital scoliosis.

metrical on both hands through three generations, about 75% of the family being involved.

We have noted congenital contracture of the fingers in two cases.

24. B. A. 5 mo. Contracture of the 4th finger of left hand. Condition closely resembles snapping finger and is possibly due to thickening of the sheath of the flexor tendon. This condition is uni-lateral without hereditary tendency. It yields readily to splinting.

25. H. A. 2 yrs. Contracture of the 2nd, 3rd and 4th finger in flexion of the left hand. No bone deformity. Skin webs holding 3rd, 4th and 5th fingers in position, leaving 2nd finger and thumb free. The case is complicated by very remarkable developmental changes in the spine and thorax. There exists congenital elevation of the left scapula, fusion of 3rd and 4th rib, right side. Irregular web shaped formation of the 5th dorsal vertebrae and fusion of the 5th and 6th rib, left side.

The deformities of the spine, scapula and ribs indicate a central lesion and exclude any explanation by amniotic construction. Case treated by skin plasty and deformity corrected.

Summary

1. Of the 25 cases reported, hereditary tendencies were in evidence in 5 cases, deformities of the hand being found in other members of the family in 3 cases, other deformities or anomalies in 2 instances. Identical deformities in family twice, one case of syndactyly and one case of congenital club hand.

2. Complicating deformities of the extremities were found in 15 cases, among which complicating deformities of the hand 4, namely; Symphalangism in 1 case of syndactyly; Syndactyly in one case of congenital ulnar club hand; Syndactyly in one case of contracted club hand, and Syndactyly in one case of lobster claw hand.

3. Complicating deformities of the spine and thorax were found in 3 cases.

Rhachitic deformities of spine and thorax in 1 case of syndactyly.

Congenital scoliosis with wedge shaped vertebrae in 1 case of contracted club hand.

Elevation of scapula, wedge formation of vertebrae and fusion of ribs in one case of congenital contractures of the fingers.

4. Complicating signs of degeneration and general developmental aberrations were found in 5 cases:

Acrocephaly in 1 case of syndactyly.

Malformation of genitals, high palate in 2 cases of contracted club hands.

High palate, malformation of maxilla in 1 case of contracted club hands.

Cleft palate in 1 case of aphalangism.

Three cases of this group showed deformities and contractures in all extremities.

5. Birth complications were found in 4 cases.

Instrumental delivery in 3 cases (1 syndactyly, 2 congenital club hands).

Twin birth and chord constriction in 1 case (contracted club hands and general contracture).

6. Primary developmental errors were assumed to be the causative agent in the majority of cases, in one case only amniotic constrictions could be held responsible; polyglandular (endocrine) dysfunction was suggested in 3 cases by malformation of the bones of the head and genital hypoplasia.

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THE PRINCIPLES OF TREATMENT OF CONGENITAL TALIPES EQUINO-VARUS

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PATHOLOGICAL ANATOMY

Two points in the treatment of congenital talipes seem to me to require emphasis. It is essential that we should think more of the resulting functional use of the foot than of the apparent correction of the deformity. This necessity has not always received the attention that it deserves from orthopaedic surgeons, this is the first point, the second is that when a cutting operation has to be performed the actual procedure adopted should be based upon the known pathological anatomy of the deformity. Most of the operative procedures that have been advocated either fail to take account of the pathological anatomy at all, or interpret it wrongly. The following brief account of the pathological anatomy is based chiefly on Walsham's description, this in its turn takes into account the anatomical descriptions of Scarpa, Adams, Shattuck, Parker, Besselhagen, Scudder, Hoffa and Redard.

Walsham groups cases into (1) children with congenital club foot upon which they have never walked, and (2) relapsed and inveterate cases in which the foot has been walked upon in the deformed position. It will be simplest to take the latter class first indicating which of the changes seen in them are already present in the infant. The chief points for consideration are:

1. The alteration of relationship between the bones.
2. Alterations in the articular facets whether primary or secondary to the deformity.
3. Alteration in the shape of the bones.
4. Shortening of ligaments and
5. Shortening of muscles and tendons.

In describing the anatomy of an inveterate case I shall refer to a specimen of congenital club foot which had never been treated and which was removed by amputation by me from a woman 38 years of age, the changes present are essentially the same as those described by Walsham, and I have been able to compare the speci-

men with Walsham's which are at present in the museum at St. Bartholomew's Hospital.

The chief factor in the varus part of the deformity is a displacement of the scaphoid and cuboid inwards at the midtarsal joint with a rotation of the os calcis which brings its anterior extremity downwards and inwards. The chief anatomical factors in producing the equinus part of the deformity are plantar flexion of the ankle joint and a displacement of the scaphoid downwards in its relationship to the astragalus. In most descriptions much emphasis has been laid upon the deformity of the bones themselves particularly of the astragalus and os calcis; both Walsham and Tubby consider that these alterations constitute a large part of the anatomical deformity in the inveterate case, it is necessary therefore to consider what the changes are.

The astragalus lies in a position of plantar flexion at the ankle joint, the most striking abnormality is an increased obliquity of the neck of the bone downwards and inwards. The measurement of this obliquity would appear to be a difficult matter. Parker measured the inward obliquity as follows: The astragalus with its trochlear surface upwards and horizontally was placed beneath a fine thread fixed across it, a second thread was fixed at right angles to this along the midline of the trochlea and parallel with its inner border, whilst a third was placed along the outer margin of the neck of the bone so as to intercept the other two. The angle formed by the meeting of the two threads last described was taken as the measurement of the obliquity of the neck. Using this method a good deal must evidently depend upon the decision as to which is the inner border of the neck. In the normal astragalus, the anterior articular facet (for the scaphoid) is well marked and its outer edge marks the anterior extremity of the neck of the bone, but in a case of an old standing talipes the outer part of this particular facet has never been in contact with the scaphoid, is denuded of cartilage, flattened and often separated from the rest of the articular facet by a marked projection. If this latter projection is taken as the anterior extremity of the outer margin of the neck the apparent inward obliquity will be very largely increased. Parker's measurements were as follows:—for the normal adult from 0° to 26° with a mean of 10.65°. For the foetus at term from 35° to 42° with a mean of 38°. For cases of talipes from 31° to 64° with a mean of 49.6°. A striking point in these figures is that there is a

greater difference between the angle in the normal foetus and the normal adult, than there is between the child with talipes and the normal foetus. It seems probable that the proper development of the outer part of the articular facet for the scaphoid depends upon the latter bone coming into working relationship with it. In the foetus the foot is habitually inverted, eversion only becoming the habitual position after birth, probably the adult type of astragalus develops only after the foot begins to bear weight.

The second point in the figures is that the difference of angle between the foetal and talipedic types amount only to an average of 11.6°, whereas the angular inversion deformity in a bad club foot is 90° or more, this inward obliquity of the neck of the astragalus can therefore only account for a small fraction of the deformity. The downward obliquity of the neck according to Walsham and Parker varies greatly in different cases amounting on an average to some 40°, the maximum being 70°. It also is partially accounted for by a mal-development of the upper part of the anterior articular surface. It would appear, however, that when there is much downward obliquity it forms an important element in the equinus part of the deformity. The alteration in the articular facets of the astragalus is of great importance. As already mentioned the active anterior facet for articulation with the scaphoid faces downwards and inwards and includes the area which in the normal bone articulates with the inferior calcaneo-scaphoid ligament. Above and to the outer side the scaphoid facet is flattened and denuded of cartilage and often marked off from the active facet by an angle so that the anterior end of the astragalus forms a cone. Over this part of the articular surface, the astragulo scaphoid and external calcaneo-scaphoid ligaments are stretched. The upper articular surface for the tibia is small and situated far back, its anterior portion being atrophic and uncovered by cartilage. The other facets are altered but the changes do not seem to be of very great importance from the point of view of correction of the deformity.

The os calcis lies obliquely, its posterior end is tilted upwards and outwards so that it lies nearer the external malleolus than in the normal foot, the anterior extremity points downwards and inwards and is at the same time twisted so that the outer surface comes to lie underneath. The articular facet for the cuboid therefore points more inward and downward and less directly forward

than in the normal foot. This position of the os calcis is simply an exaggeration of that which the bone assumes when the foot is plantar flexed and inverted. The cuboid is subluxated inwards on the os calcis, the facet for articulation with it lies to the inner side of the anterior extremity of the os calcis, the outer part of this anterior extremity is prominent and rounded forming part of the surface upon which the patient walks. Thus the anterior extremity of the os calcis becomes conical in shape. On the upper surface of the os calcis the posterior articular facet for the astragalus is shifted forward and extends on to the sustenaculum tali, the anterior facet may be absent, there may be a facet on the sustentaculum tali for articulation with the scaphoid. In the cuboid and scaphoid the chief changes are those of position, the rest of the bones of the foot are little altered.

We see therefore that in an inveterate club foot a large part of the varus element of the deformity is due to a subluxation inwards of the scaphoid and cuboid, a smaller part of the deformity to an alteration in shape in the astragalus and os calcis. The chief ligamentous structures which hold the scaphoid and cuboid in their inverted position are those which lie in front of the internal malleolus and unite it and the os calcis to the scaphoid, those are the internal lateral ligaments of the ankle joint and the internal and inferior calcaneo-scaphoid ligaments. The internal lateral ligament (deltoid ligament) is usually described as consisting of three parts, the posterior attached to the astragalus, the middle attached to the sustentaculum tali and the anterior attached to the scaphoid. The posterior part of the ligament can take no part in preventing the correction of a varus deformity, the middle fibres may prevent a correction of the position of the os calcis, the anterior fibres blend with the internal and inferior calcaneo-scaphoid ligaments into a dense and strong ligamentous mass attached posteriorly to the internal malleolus and sustentaculum, and anteriorly to the tuberosity and adjacent surface of the scaphoid. This has been named by Parker *the astragalo-scaphoid capsule*, forming as it normally does the capsule of the inner part of the midtarsal joint. In an inveterate case of club foot this capsule is converted into a dense fibro-cartilaginous mass binding the malleolus and the sustentaculum very closely to the tuberosity of the scaphoid; measured from its surface through to the neck of the astragalus the mass may be $\frac{3}{4}$ in. to 1 in. in thickness. Its appearance in my specimen shows

that it would be impossible to rupture it by force applied by the hand or by an osteoclast, the tendon of the tibialis posticus passes over this mass and is inserted into its lower part and through it into the scaphoid. It is however the fibro-cartilaginous mass that resists eversion of the foot and not the tendon. In my specimen the division of the tendon at the time of amputation did not enable any correction of the deformity at the midtarsal joint to be carried out.

The only other ligaments that need be mentioned are those at the back of the ankle which may prevent correction of the equinus part of the deformity. The posterior ligament is often blamed and a special operation has been devised for its division, dissection however, shows that the posterior ligament is a very feeble structure and it should be easily ruptured by manual force. It is possible however that the posterior fasciculus of the external lateral ligament is of some importance in resisting dorsiflexion of the foot. Finally it is said that the upper articular surface of the astragalus in a case of inveterate talipes is too wide in its anterior part to fit between the malleoli so that a resistance to dorsiflexion thus exists; I have no proof or otherwise of this assertion.

In the club foot of the young child the changes described above are all present. Parker and Walsham have shown that the alteration in the shape of the bones is already present to a considerable degree. The alteration in the articular facets is, as would be expected, less evident, and the astragolo-scaphoid capsule, though contracted and hard, is much less resisting than in an old standing case. In my opinion the importance of the tendons in maintaining a deformity has been much exaggerated. Doubtless the tendons of the tibialis anticus and posticus and the tendo-Achillis have a considerable part in the original production of the deformity; the resistence which the first two named offer to correction is, however, trivial. The tendo Achillis does offer considerable resistance as also in many cases does the plantar fascia.

To sum up the pathological anatomy, in an infant most of the deformity is due to displacement at the ankle joint, sub-astragaloid joint and midtarsal joint; a smaller portion being due to alteration in the shape of the neck of the astragalus and anterior part of the os calcis. The resistance to correction is formed largely by the astragolo-scaphoid capsule, the plantar fascia and the tendo-Achillis, the resistance of the tibial tendons being much less important. In inveterate cases the importance of the astragolo-scaphoid cap-

sule is very much greater and in addition the displacement of the anterior articular facet of the os calcis on to the inner side of the bone is very important because whereas it is possible after division of the astragolo-scaphoid capsule to replace the scaphoid upon the astragalus it is not possible to replace the cuboid on to the os calcis.

TREATMENT

In the treatment of congenital club foot in infants practically all surgeons at the present time rely upon manipulation, tenotomies, and the use of retentive splints or plaster of Paris. In my opinion tenotomy has been much too freely employed, in most cases it is perfectly easy to correct or over correct the deformity in a child under one year of age by simple manipulation under an anaesthetic, repeated if necessary on two, three or four occasions, with retention of the foot in plaster of Paris between the manipulations. The great advantage of avoiding tenotomy is that the ultimate function of the foot is thereby much improved. The method adopted by myself is as follows:

The child is operated on at the age of one month unless it is feeble and undersized, in which case the operation may be postponed until the child's general condition has been improved. Under an anaesthetic the following manipulations are carried out:

1. The fore-foot is abducted at the midtarsal joint this may be done by grasping the metatarsal heads with one hand, the heel and ankle with the other hand, the thumbs being pressed upon the outer side of the dorsum of the foot over the prominence formed by the head of the astragalus. The posterior hand supports the ankle and heel, the anterior hand abducts the fore-foot and both thumbs make firm counter pressure upon the head of the astragalus. Alternatively the hands may grasp the foot from the inner side, the pressure upon the head of the astragalus being then made with the tips of the fingers. In a resistant case the foot is laid upon its outer side across a wedge and downward pressure made upon the heel and anterior part of the sole. By these manipulations the sole is flattened, the plantar fascia and astragolo-scaphoid capsule being thoroughly stretched; the scaphoid and cuboid return to their normal positions. As a rule the first manipulation ceases at this point, the foot being fixed in plaster for a period of four to six weeks before a second manipulation is

carried out. In fixing in plaster of Paris it is important that the position and fixation shall be one which is easily maintained without pressure, that is no attempt is made to maintain the maximum correction obtained during the manipulations. If this rule is observed, pressure and constriction of the foot should be avoided. One of the most difficult points in treating a club foot is to secure external rotation, it is quite common to see a club foot corrected so that it looks very nice until the patient stands upon it when it is seen that the toe points inwards. The site of this inversion is a matter of dispute, according to Tubby it may occur in the shaft of the tibia, at the knee joint, in the long axis of the femur or at the neck of the femur. In my opinion it nearly always occurs below the malleoli and is due to imperfect stretching of the astragolo-scaphoid capsule, resulting in failure to replace the scaphoid os calcis and cuboid in their proper positions. In fixing the foot in plaster of Paris it is essential to maintain eversion, this is only possible if some fixed point is secured upon which the foot can be outwardly rotated. The only method of securing such a fixed point is to flex the knee to a right angle and to include it in the plaster of Paris. I always apply my plaster by the following method: the plaster of Paris bandage starts on the outer side of the ankle passing over the front of the joint and round the heel, it is then passed two or three times around the anterior part of the foot, all these turns being applied very loosely, next it is carried from the outer side of the front of the foot directly upwards over the top of the flexed knee, this portion being pulled tight and serving to maintain abduction and eversion of the foot. After a few turns round the knee the bandage is brought down to the foot again, and again carried upwards from the outer side over the flexed knee joint. These longitudinal strands stand away from the leg, in completing the enclosure with plaster they are bandaged in, moderately tight, the tension upon them thus being increased. The final position then is that the knee is flexed to a right angle, the foot plantar flexed, abducted and externally rotated.

When this plaster is removed, the second stage of treatment is carried out, the manipulations being as follows: (1) Those carried out at the first stage are repeated in order that correction in the midtarsal region may be secured to the fullest possible extent. (2) Then holding the foot in the abducted posi-

tion it is dorsiflexed steadily and strongly, stretching the tendo Achillis. As soon as it reaches the right angle the whole weight of the body can be put upon the anterior part of the sole, forcing the foot into further dorsiflexion. At the same time the foot should be forced directly backwards, the other hand of the manipulator supporting the back of the calf, this is necessary because there is a tendency when the equinus part of the deformity is corrected to displace the foot forwards at the ankle and shorten the heel. These manipulations should be carried out by repeated steady pressure, no attempt being made to rupture structures by suddenly exaggerated force. When the foot comes easily 20° to 30° over the right angle with the knee extended, correction may be considered complete, and a plaster is applied by the same method, but with the foot, this time, in dorsiflexion. This second plaster is maintained for six weeks and if at the end of that time correction is good, a simple club foot shoe is used with daily manipulation of the foot. When the child starts to walk he does so in the club foot shoe. When he is walking well it is necessary to decide whether a walking appliance is required or not. The child is allowed to walk without an appliance, if he lifts the foot in an abducted position showing that there is good power in the peronei and in the extensors, an appliance will probably be unnecessary. If he tends to walk on the outer border, a short inside iron, fitted to a boot of which the outer side of the sole is thickened ¼ in., with a varus T strap will be required. I find that a longer instrument is practically never necessary.

It is not always possible to correct the equinus part of the deformity by manipulation alone, it may be found that such manipulation either fails to get the foot beyond the right angle or secures this correction by movement at the midtarsal joint and not at the ankle joint. In my opinion the tendo Achillis should only be lengthened when there is a failure to correct the equinus part of the deformity by simple manipulation, and if tenotomy is required it is best to leave it until the child is nearly a year old when the tendon is large enough to allow of a subcutaneous lengthening operation. Tenotomy of the tendo Achillis is not a trivial operation and it leaves a permanent weakening of the foot, it is always evident that tenotomy has been performed by the alteration of the shape of the calf, the muscular

part of which is at a higher level than in a normal leg. This "high calf" means that the muscle has undergone a permanent contraction and that it possesses a less power of shortening than it did. In many cases the patient is unable to rise on to the toe. There can be no doubt that the function of the foot is better in cases which have been corrected without tenotomy.

It is essential that the correction of club foot should be carried out in the order described above, that is, the flattening of the sole, and the abduction of the fore part of the foot must be completed before the equinus portion of the deformity is corrected. A premature correction of the equinus by division of the tendo Achillis leaves an imperfect foot, very liable to relapse, which it is exceedingly difficult to correct satisfactorily by any subsequent operation.

RELAPSE

Relapse occurs in the practice of all surgeons and after every method of correction. When a relapse occurs in a patient of mine, I know that it is due either to imperfect correction or to inadequate attention to after treatment. Most often a relapse is due to failure to over correct the varus part of the deformity at the first stage of the treatment. Relapse occurs not only after treatment by simple measures such as manipulation and tenotomy, but also after the most drastic operations including the removal of wedges, the removal of the astragalus and Phelps' operation. As relapses do occur and as in a certain proportion of cases a club foot does not come under surgical treatment until a late stage, we must be prepared to deal with club foot deformity in older children and even in adults. We should attempt to correct the deformity in such a way as to leave a good useful foot. The foot should be planti-grade, the heel and heads of the metatarsals meeting the ground, the ankle must dorsiflex well over the right angle and plantar flex at least 30° to 40°, the midtarsal joint must be mobile and there should be sufficient muscular power to permit of the patient rising on tip toe, on each foot separately. He should also be able to dorsiflex the foot without inversion and if possible should be able to invert the foot.

The procedures recommended by various authors for the

treatment of relapsed or inveterate cases of club foot are as follows:

1. Forcible correction at one or two sittings with fixation in plaster of Paris. (Lorenz).

2. Repeated manipulations every few days then fixation in plaster of Paris. (Wolff).

3. Forcible correction with a Thomas' wrench or other mechanical appliance.

4. Subcutaneous division of those structures which resist, or are thought to resist correction with immediate reduction of the deformity and fixation in plaster. The structures divided are generally the tibialis anticus and posticus, the astragalo-scaphoid capsule (recommended by Parker), the plantar fascia and the tendo Achillis. Most surgeons have carried out this line of treatment in two stages; this is the method recommended by Walsham for severe degrees of club foot in children.

5. Subcutaneous division of the resisting structures without correction at the time, the foot is being gradually strengthened by the use of one of the varieties of Scarpa's shoe. This method was for long the favourite one of Adams and of the surgeons at the National Orthopaedic Hospital, it is slow but in skilful hands yielded a very perfect correction, even in most severe cases.

6. Phelps' operation, that is the division of all the structures of the sole and inner side of the foot right into the midtarsal joint. Lane's operation was a similar but even more drastic procedure. These methods are irrational and barbarous. In dividing the structures which really resist correction, many important and innocent structures including the vessels and nerves of the sole are cut quite unnecessarily.

7. Open operations. The most important of these are the removal of the cuboid (Solly); the removal of a wedge of bone from the outer side of the foot (Davy); astragalectomy (Lund); and transverse division of the tarsus. (Symonds).

Of these the removal of a wedge and astragalectomy are the favourites, they are in my opinion deforming operations and ought to be abandoned. The removal of a wedge interferes with the action of the joints and leaves a shortened and stiff foot, relapse occurs because the astragalo-scaphoid capsule has not been

touched. Astragalectomy destroys both ankle and midtarsal joints; it is advocated both by Walsham and by Tubby on the ground that a malformation of the astragalus is an important anatomical factor in the deformity. I think the importance of this factor has been exaggerated. If a deviation of the neck of the astragalus is important, it can be corrected by a transverse osteotomy without interfering with either ankle or midtarsal joint. It is well known that after an astragalectomy there is a tendency for the foot to turn into the varus position, it is therefore not to be wondered at that relapse occurs after this operation.

The methods which I now adopt for the correction of severe club foot in older children or in adults are as follows:

First. At one or two sittings I attempt to manipulate the foot into shape, using the hands, a wedge and if necessary a Thomas' wrench, fixing the foot in plaster of Paris upon each occasion by the same method as that already described for use in infants. As soon as it is evident that a complete correction by these methods is impossible, I tackle the problem by an open operation which is intended to remove all obstruction to a complete correction of the varus part of the deformity. The obstructions I believe to be the following: 1. The astragalo-scaphoid capsule including the anterior part of the interior lateral ligament and the attachment of the tibialis posticus tendon. 2. The displacement inwards of the cuboid upon the os calcis, and 3. The inward and outward obliquity of the necks of the astragalus and of the anterior part of the os calcis. The complete operation is as follows:

A. An incision is made over the internal malleolus and carried forward along the inner side of the foot, the tendon of the tibialis posticus is exposed and hooked aside, beneath it the anterior 2 3ds of the interior lateral ligament is cut away from the malleolus, the astragalo scaphoid capsule will be found as a thick mass of fibro-cartilage in front of the malleolus; this is cut away completely until the head of the astragalus is exposed, the tuberosity of the scaphoid cleared upon its posterior and inferior aspects, the sustentaculum tali cleared, and the fibro-cartilagenous mass remains attached only to the tibialis posticus tendon. The latter is then cut through so that the calcaneo scaphoid capsule is entirely removed.

B. A small incision is made just below and in front of the tip of the external malleolus, through this an osteotome is inserted down to the os calcis which is divided transversely about ½ inch behind its anterior border. An endeavour should be made to bring the osteotome out on the inner side immediately in front of the sustentaculum tali. The whole of the anterior part of the foot can now be abducted and elevated, the scaphoid moves on the astragalus; the cuboid cannot be abducted on the os calcis but it carries with it the anterior part of this bone. If it is thought that an obliquity of the neck of the astragalus is an important element in the deformity an osteotome is inserted and the neck of the astragalus divided transversely; complete correction of the varus deformity and of that part of the equinus situated in front of the ankle joint is now possible. The incisions are sutured and the foot fixed in plaster of Paris in a fully correct position by the usual method; the knee joint being flexed and included in the plaster. When this plaster is removed at the end of six to eight weeks if any equinus remains this is corrected by manipulation and lengthening of the tendo Achillis, if this is necessary. It may be found impossible to dorsiflex the foot beyond the right angle even after lengthening of the tendo Achilles, this is rare perhaps because in relapsed cases the true equinus has practically always been previously corrected. If it is thought that the front of the upper facet on the astragalus is too narrow to fit between the malleoli, it may be advisable to cut down upon the external malleolus, to divide the posterior fasciculus of the external lateral ligament, and to cut through the base of the external malleolus into the ankle joint; this, by allowing separation of the malleolus should enable complete dorsiflexion to be carried out. I have not yet carried out this procedure, but it seems a rational one in suitable cases. I do not believe that internal rotation will be found to be common in club feet which have been fully corrected at the midtarsal region, but when such internal rotation exists, I have no hesitation in correcting it by division of the tibia and fibula. I have already said that I believe relapse to be most often due to an initial failure to secure complete correction, therefore the chief method of avoiding relapse is by making sure that correction is complete. Occasionally it is advisable to use another method of preventing relapse either because the patient is going to a dis-

tance which renders it impossible to keep up adequate after supervision, or because it is known that the parents will not take sufficient care in carrying out after treatment. In such cases a transplantation of the tibialis anticus to the cuboid is a more certain preventive of relapse than any other method. In some club feet the peronei fail to recover their power and remain functionless, so that even with full correction and maintenance of the correct position for a year or more the foot still cannot be actively inverted; transplantation of the tibialis anticus is then necessary.

DISCUSSION

MR. AITKEN: I have listened with very great interest to Mr. Elmslie's paper. I have seen innumerable cases of club foot, and find there is a great distinction between infants' club foot, and adults' club foot, because in the adult club foot degenerative changes have already taken place; the foot has been walked on, and the foot that has been walked on is bound to differ from the foot that has never been walked on. I think it is pretty well known that the angle Mr. Elmslie describes as being found in the infant, has been described as a characteristic of races which do not wear boots, the Zulu, etc. At the same time, he made a very interesting explanation as to how the articular surfaces are different in infants and in adults.

(Mr. Aitken illustrated his remarks with photographs of some of his cases before and after operation.)

MR. BENNET: With regard to Mr. Elmslie's remarks about the correction of the deformity of congenital equino-varus, I always do it at one sitting in young children. I rarely touch the tendo-Achillis, and I rarely have to manipulate again after the first manipulation. The reason of that is, that I do not put them up in plaster, but use an apparatus which, as far as I can see, is simple and effectual. In this apparatus I let the child walk.

MR. PLATT: Mr. President, ladies and gentlemen, Mr. Elmslie very wisely dealt with the principles of correction in all types of congenital talipes equino-varus only. It would take too long to deal with all types. One point appeals to me very much,—I am not quite certain whether he mentioned it or not—that is, the most difficult element in any deformity is the inversion, not of the mid tarsal bones, but the inversion of the os calcis. For instance, in Mr. Bennet's photographs, the most marked deformity is the inversion of the os calcis; also, in cases which have relapsed, and in cases which have been partially treated, the outstanding deformity is the inversion of the os calcis. Photographs taken of patients, from the front, very often do not show this. The only test of a true correction, of a real correction, is the everted os calcis when the patient is standing. That is dealt with very little in literature on the subject, and, in my opinion, it is the most difficult part of the deformity to get rid of.

MR. FRASER: No one has raised the point of adduction in talipes. In children and in these relapsed cases, the adduction is so persistent that we now remove a wedge from the outside of the foot. Then we go to the inner side, open up the foot, and transplant that wedge to the inner side. Most of our best results have been obtained through the medium of that operation. I should like to know anyone's experience on that point.

MR. ALWYN SMITH: I think the main point of the whole treatment of equino-varus is to get it early. That point will have to be brought up in the new Hospital Scheme. When club foot is treated early, and treated

practically from birth twice a week by manipulations, then we shall not get so many relapsed cases. We all know that our results in this type of case are always better in private practice than in hospital, and for the simple reason that we have more time to devote to them and they are not left to others who perhaps are apt to neglect the after-treatment.

I was brought up to treat club foot cases practically from the earliest days, and then, when I went out to Canada, I found that where cases are several hundred miles away, it is not possible to treat them in that way. The cases are therefore treated by being brought into the city at the age of twelve months, and I am sure the results are nothing like so good. We used to divide the tibialis posticus and the calcaneo-scaphoid ligaments and abduct the foot in plaster, and, at a later stage, in three weeks' time, divide the tendo Achillis, and we invariably got a pipe stem leg. On one occasion, I divided the tibialis posticus and everted the foot, and I got a bad case of what really came to an infantile type of flat foot. I am quite sure that, if we get the cases early and treat them with club foot shoes or by plaster, we shall get very much better results. The main point, of course, is, that your condition is not cured until your muscular balance is restored. I think that is chiefly why hospital cases are so apt to come back. They are put into boots and irons, and sent out. The boots are too big, and the foot inverts in the boot, and they come back with the secondary deformities such as have been described. You don't get that sort of thing in private work.

As to treatment, in the first month or two I divide nothing at all. I do everything by hand—and of course in these young children I never give an anaesthetic. I give them a good wrenching the first day, when the foot is of course very much swollen. I treat it four days like that, and then I put the foot up in plaster or in a club foot shoe. The swelling will then disappear, and you can put it in the over-corrected position without any fear of getting pressure sores under strapping or plaster.

Mr. Fairbanks: As regards the use of tenotomies in the early stages, I think, if the child is likely to be adequately looked after afterwards, tenotomy is inadvisable. I think that relapse is certainly more likely to occur if tenotomy has not been done; therefore one resorts to tenotomy when one feels that the after treatment is not likely to be thoroughly carried out. In regard to relapse. It is not always our fault. The child often gets ill from heaps of other things, during which time the treatment must be discontinued, and of course, the interval between upsets the whole thing.

As regards rotation, I do not think I agree with Mr. Elmslie. I think there is rotation in the leg above, in the tibia and fibula; in some cases it is very marked.

As regards the tenotomy of the tendo-Achillis giving rise to very poor function, I think one has got to remember that it is only in severe cases that we do this, and of course there are heaps of other factors connected with the function. It is not fair to the tenotomy of the tendo-Achillis to accuse it of having produced the bad result.

There is one point that has not been referred to, and that is the want of growth in the limb, shortening. In the treatment of club foot, the usual thing is to get the foot into good position and then give the child a high boot, with a thick sole. I think that is very rough on the child. It seems to me that to put some kind of apparatus on one foot and to retain it for four or five years, whilst the other foot is all right, is bound to give shortening.

Mr. Haughton: There is one point that appeals to me. In the treatment of very young children, from one to three months of age, I have endeavoured to get results by manipulation, followed by plaster. When the child turns up, three years of age, untreated, having treated the foot by manipulation, and failed, I then proceed to deal with it by tenotomy and wrenching, leaving the tendo-Achillis till a later stage. If the deformity still persists, it is of course evidence that a contraction exists between some of the deeper

structures. . . . I have then attempted to divide the calcaneo scaphoid ligaments, a procedure that has, as a rule, got rid of the vertical crease in the mid tarsal region. I am much obliged to Mr. Elmslie for calling my attention to this structure.

Mr. Girdlestone: We all believe that results can be obtained more quickly, more permanently, without any serious operation at all, if the cases are treated early, but it has not yet been decided how we are to get the cases early. One might just mention that it is mostly by co-operation between the public authorities. If we can only get the interest of the Medical Officers of Health, and get them to instruct Midwives, Health Visitors, official and unofficial, who see the children, to report the cases early, that will be a great step forward. I think all of us aim at co-operation and agree that it is only by co-operation with the new Health Organizations that we shall get the little children early under treatment.

Mr. Elmslie mentioned the importance of a slow, steady pull, particularly in stretching the tendo-Achilles. I personally feel that I should like to emphasize that. There is a great danger, in endeavouring to stretch the tendo Achilles, that one may pull off the insertion to the os calcis. I would like to mention that as a possible danger.

There is one more point, after-treatment. I think that many of us feel that plaster of Paris is the only really satisfactory apparatus until we have got the muscle balance restored; and if we replace the plaster of Paris and allow the child to walk in the plaster, changing it again and again until it walks naturally and can evert and dorsiflex its foot. It can then be put into shoes with a slight raise on the outer side, and it can walk easily and without any apparatus at all. The main thing these children need is supervision for some time after treatment, and that must be provided for under the new Health Schemes.

Mr. MacMurray: As regards the point that Mr. Platt has raised regarding inversion of the heel, there is no doubt at all that that is the difficult point. Abduction of the midtarsal joint is comparatively easy—by your hands, your wrench, or the wedge—it is quite otherwise with the adducted heel.

In regard to relapse. I have been told that there is no relapse of the club foot. There is reappearance of uncorrected club foot, but, in a case that has been corrected so that the child can evert the foot and hold the foot everted, the foot will not relapse.

There is one other point—inversion of the foot, in-turning of the foot, so that the child walks hen-toed. That rotation is undoubtedly, in my opinion, between the knee and the ankle.

Mr. Trethowan: I, personally, have never seen inversion of the leg. Regarding this question of rotation, I think there is a certain amount of inversion of the astragalus, and I think the whole thing could be corrected without tenotomy at all if you got it in the early stages. I do not agree that plaster is so useful. One has gone through that phase—but I do think the tiniest foot can be better controlled with the splint. I think it is physically impossible to put these tiny feet in plaster, and I think in the early stages, a carefully applied splint is much more useful than plaster. Then, at a later stage, when the foot has been corrected, the club foot shoe is useful for keeping the foot corrected. In my opinion, to correct the tendo Achilles plaster is not so efficient as a splint in the early stage.

Mr. Dunn: I would like to ask Mr. Elmslie why an amputation was done in the specimen he showed us. There is nothing in the appearance of this specimen to make one think that an amputation would give the best result.

The other point is, that, in a little child under three or six months, it is practically impossible to maintain over-correction by plaster of Paris. The foot is only 2 in. long, and, covered with wool or felt, you can hardly get hold of it. I believe that all children's feet can be corrected by strapping.

Mr. Leaming Evans: In regard to the neck of the astragalus, referring to the authorities of the past, I accused the neck of the astragalus of excessive inversion in all cases of talipes. It is very difficult to measure young children, because we do not get the specimens, but I have removed the astragalus from 30 adult cases and I have been unable to confirm the observations in regard to excessive inversion of the neck. It is, of course, more than normal, but I think it has been grossly exaggerated. Operations designed to correct that, have been founded on false ideas of the anatomy.

In regard to treatment in infancy, there are all sorts of methods, and most of them are good, and I think the point for the practitioner to get hold of is to follow the line he has been taught: if he finds one method better than another, let him stick to it.

There is no doubt that the supination of the sub-astragaloid joint is the most difficult part of the deformity to correct in infancy, and I am quite certain you cannot do that except by division of the structures in the sole and of the tendo Achilles at the same time. In regard to treatment of adult cases, the appearances of the foot are so different in different cases—some rest on the cuboid, and some on the anterior end of os calcis, and others on the base of the fifth metatarsal, and others on the dorsum, so that the weight is almost on the head and neck of the astragalus—no one particular operation could satisfy all the demands, and I think in certain cases one would have to remove the astragalus, to do a large bone operation. I do not think that Mr. Elmslie would suggest that his operation is a panacea for all these evils.

There is one remark I would like to make in regard to the operation of astragalectomy for the correction of this deformity, and that is that displacement of the foot forwards, as it occurs in a congenital club foot, could be corrected by a displacement of the foot backwards when the astragalus has been removed, following the plan that Whitman adopted in the case of his well known operation for paralytic calcaneus.

Mr. Ollerenshaw: In children of walking age, it is as well to get them walking as soon as possible in the plaster. I allow them to walk in it on a thickened sole.

Mr. Bankart: In regard to rotation of the os calcis, it is an extraordinary thing that I have not been able to find even an adequate account of the movements of the sub-astraguloid joint in any text-book. There is an admirable description of it in Wood's "Anatomy," of 1838, I think. The os calcis rotates about an axis which passes between its body and its lesser process. * * * Its movements can be worked up quite easily in an articulated foot, and, although they are quite slight in the normal foot, they are grossly exaggerated in this form of deformity. In attempting to find a cure in the older cases, you must first tackle the displacement of the subastragaloid joint. I divide everything between these two bones, and turn the outer border of the foot outwards. I am still trying to find some way of fixing it there. In some cases I use artificial silk ligaments.

Sir Harold Stiles: I am not going to speak as an Orthopaedic Surgeon, because I am not one. I want to seize this opportunity of stating a hope—seeing that our Orthopaedic specialists have shown us that there is a great deal of difficulty about the treatment of club foot, and that there is even some difference of opinion about the treatment, that they have spent most of their lives in treating club foot and even with that have not succeeded in always producing the perfect result—I think that there is a claim that we ought to put forward in the year 1920, that all these cases should be collected into a special department of the General Hospital. They should be put in the hands of men who are going to devote the whole of their time and attention and skill to these very important cases. There is one point on which all of us will agree, and that is that now that the new Ministry of Health is going to be formed, there should be no such thing as the treatment of club foot except in the early stage. It is at this stage that the treatment is so effectual.

In regard to my friend's Mr. Dunn's remarks that we can dispense with plaster altogether, I think plaster is an unsatisfactory way to treat. We do not know exactly what the position of the foot is in the plaster. In a little child, it is a very easy matter to evert the foot in carrying the plaster round the anterior end of the foot, so that the foot is fixed in the wrong position.

I am not going to say anything more about the pathological anatomy, etc., although of course, there are many points I would like to discuss. As to rotation, I am certain there are some cases in which there is rotation below the knee, and there are cases in which there is no rotation. There are cases where the os calcis is well developed, and where the os calcis is badly developed, where there is moderate varus and a good deal of varus; therefore, you have to cut your coat according to your cloth.

Sir Robert Jones: I think we have had a very interesting discussion, although the subject seemed a very general one. It shows how many-sided the question is, but I think if a man has got a good routine, that has been satisfactory to him, he ought to keep to it. We cannot all grasp new things just as they are shown us.

One thing I would like to mention—there has not been much said about the removal of large masses of bone. That is the sort of thing we do want, if we can, to see obliterated. I have never seen a case of club foot where a good portion of bone has been removed, where the foot has functioned well.

There are certain principles which I think you ought all to take for granted as forming the basis of all treatment. Whatever method of treatment is adopted, there should be a complete over-correction, not merely correction, over-correction is essential.

It has been said that sometimes you have a twist in the tibia and fibula, and sometimes a twist below the malleoli. I am perfectly sure that there are cases where the rotation is between the knee and the malleoli—undoubtedly a number of cases prove that.

There are two great principles, and, after over-correction, I think the other principle is to see that you get the restoration of the muscles of eversion. If you ask how you are to know if these muscles have been restored, the test of the recovery is that the patient voluntarily can correct this deformity. Until that happens, you cannot be said to have cured the condition. You have to train the muscles until they are strong enough to hold the foot in good position.

What are the causes of relapse? I suppose insufficient correction is the chief.

Mr. Fraser raises an interesting point when he mentions the removal of bone from one side of the foot to the other. That has been done largely in America. I have not seen a case myself.

As regards the treatment of the condition in young children, by manipulation, there are many ways in which that can be done. Some do it at one sitting, and some at several sittings, in any case, you have got to get it corrected either slowly or rapidly. What are the dangers of manipulation in these young children, and in older children? The danger is that you often don't protect the knees from strain, and the result is that you have then a knock-knee as well. You have got to be very careful in putting the cases up in plaster afterwards. Put it in the flexed position, with no strain on the internal lateral ligament in doing it. Correct the deformity, evert the foot, fix it in plaster, and watch the child until it has recovered. When the child is of walking age, get it to walk on the sole of the foot, without a splint of any sort, on the flat of its sole, with its toes turned out. That is very much better than using splints.

I have always had a great horror of a splint which is carried above the knee, I have even seen them sometimes above the hip. It is an extraordinary procedure, quite unnecessary, and it is not nearly so effectual as over correction.

As regards eversion of the heel. My own view in this matter is that when we have a marked case of inversion, as a rule, if it is corrected by the wrench,

and the foot worked at carefully, in about ten minutes you can over-correct most of the inversion of the os calcis.

We have all had relapses, very often I think, because in the treatment of club foot, you have to trust to other people constantly. Let me say this, whatever the method is, you may bring about success; even in adult cases, it is possible to produce normal feet from absolutely old rigid feet. Some time ago, I had an adult case with Professor Lovett, of Boston, a case of two feet in an adult of 24 years of age. We said, "We will do two operations; in one case, we will perform tenotomy, and in the other trust entirely to the wrench." We took the wrench, and, in six or eight weeks, I think I made two attacks upon the foot. We found that correction by the wrench gave the best walking foot. * * * The main point is to over-correct the deformity, and see that the child begins to walk, which will at least help to diminish rather than increase the deformity.

Mr. Elmslie (Reply): As regards the strain at the knee, I fully appreciate the necessity for being extremely careful of the knee and fixation of the foot in plaster, and I think your point is met by the point on which I laid emphasis. I think it is essential, in fixing a club foot in plaster, to hold the foot in the position which is easily maintained, to put on the plaster practically in a position in which there is no strain at all. In these cases, I get the result chiefly by manipulation, and then apply the plaster in a position in which there is no strain at all. As regards the remarks of Sir Harold Stiles and Mr. Dunn, personally I do not put any wool or felt in the plaster, just a thin layer of stockinette. I perfectly agree that plaster is not essential, and if I had my children in a nice country hospital, with adequate nursing, I should probably not use plaster at all, but, if any of you will come and see me working in a large hospital, where we have to treat very large numbers in the patient department, I think you will soon see that anything but plaster is out of the question. Mr. Trethowan says he has passed through the plaster phase and come to the splints; I again, have passed the splint phase and reached the plaster.

With regard to the division of the tendo Achillis, I was glad to hear Mr. Alwyn Smith mention the danger of the pipe-stem leg. That is a most important thing, and ought to be emphasized.

Sir Robert Jones has laid down certain principles of correction. The most important item of the whole lot is to get a good functioning foot, and if, by division of the tendo-Achillis, we are going to get the pipe-stem leg, let us avoid the division of the tendo-Achillis. Remember this, that division of the tendo-Achillis has got into the books as a routine treatment for club foot, with a result that, when I get a club foot sent in by a country surgeon—who has already had an attempt to correct it—that child has always had the tendo-Achillis divided the first thing. That is what we want to stop, and that is why I want to be so emphatic about the division of the tendo-Achillis.

The second point is bone operations. I did not read the section of my paper which dealt with this point. I feel that Phelp's operation, astragalectomy and of tarsectomy, are unjustifiable operations which have been preached by surgeons unnecessarily. I think Phelps' operation utterly irrational. Why should you go and divide the two plantar nerves and plantar arteries when you can avoid them? After astragalectomy, for some reason the tendency is for the foot to go into a varus position. . . . I think it is an operation which is based on an unsound idea of the pathology of the condition.

A SYSTEM OF JOINT MEASUREMENTS

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In the literature may be found various forms of expressing the limits of motion or angle of deformity in joints. When an angle is specifically stated in degrees the reader is sometimes at a loss to know just which angle is meant, whether it is the angle included between the two bones concerned in the deformity or movement, or the angle between one of the bones and an imaginary line projected into space from the other bone.

If one reads for instance, "flexion deformity of the knee of 10°," it is usually safe to assume than an angle, one of whose sides is an imaginary line, is meant, but if a larger angle is mentioned, as "60° flexion," the record is ambiguous; it may mean a moderate flexion or a very marked flexion, depending on which angle was measured.

In the French literature usually the angle included between the two bones is used in expressing the degree of mobility or deformity. This is evident from the fact that the degrees when specifically stated are usually high, for example, "il y a un flexion de la jambe sur la cuisse a 135°," and "flexion considerable de la jambe sur la cuisse, mesurant 120° environ." There are some exceptions to this, however, for example, "abduction active du bras atteint 40° 1′ extension 40°." Examples of ambiguous statements in the English and American literature are numerous and there is no particular object in referring to them specifically.

Very few attempts have been made to establish a standardized system of measuring angles of deformity in joints Nutter suggests a method of recording movements of the fingers and of rotation of the forearm. He also mentions the importance of accurate records for the use of pension boards in making decisions in cases of deformity following war injuries. Marble has appreciated the necessity of accurate measurements and has used simple copper and wood frames that fit over the limb on which degrees are indicated with a dial and a pointer. Details of the instrument are lacking.

The system which seems most rational and which the writer has been accustomed to use is that in which the arc of the angle included between the bones on either side of the joint is used to express limits of motion or angle of deformity. In this system, complete extension of any joint (the temporomaxillary joint is not considered) is 180°, or a straight line. In Figure 1 all the joints are represented in complete extension. It is that position in which the part distal to the joint concerned points toward the toes and is parallel with the lateral plane of the body. It is assumed that the palms of the hands face foreward. All movements except those of extension and except supination of the forearm take their beginning from this neutral position. Any movement from this neutral position except external rotation, implies a reduction in the size of the angle.

Extension and external rotation are the only movements which produce an increase in the size of the angle. Extension begins theoretically as 0° and stops at 180°. Any movement beyond that arc is recorded as hyperextension and is regarded as analogous to flexion, but in the opposite direction from flexion. The limit of extension may be expressed by "extension to 160°." This does not imply that the part has moved through an arc amounting to 160°, but that the movement stops at that angle. Hyperextension is expressed in degrees of the included angle, as, hyperextension to 170°, not hyperextension of 170°.

In this system, the stated number of degrees does not represent the number of degrees of an arc through which the part has moved, but the angle on the half circle scale from 0° to 180° at which it stops. The degrees express the limit of motion and not the amount of motion.

Flexion is defined as the movement of a joint in an anteroposterior plane in the direction of its greatest range. For all joints except the spine this movement is cephalic in direction, and for all except the knee and toes it starts in an anterior direction. Due respect is accorded to the fact that anatomic flexion of the ankle is a posterior instead of an anterior movement, but for clinical parlance, the anterior motion has come to be regarded as dorsalflexion. Flexion of any joint begins at 180° and approaches 0°, being in inverse proportion to the angle. The same is true of hyperextension. The limit of flexion is expressed by "flexion to 80°," not flexion of 80°." In describing a joint ankylosed in

flexion the use of the preposition "at" precludes ambiguity, for example, "bony ankylosis at 150°."

Abduction starts at the same straight line of 180° and implies a movement away from this line and away from the median line of the body in an arc approaching 0°, just as in flexion, but in a plane at right angles to flexion, as "abduction of the thigh to 110°." The angle measured is that included externally between the member moved and the cephalic part of a line passing through the joint

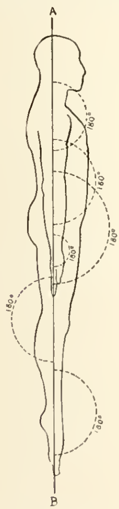

FIG. 1. Neutral position, complete extension of all joints.

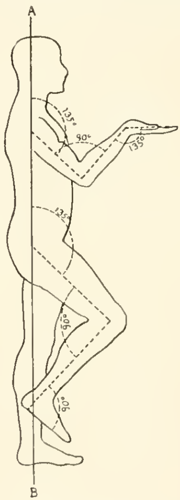

FIG. 2. Flexion, shoulder to 135°, elbow to 90°, hip to 135°, knee to 90°, ankle (dorsal flexion) to 90°, hyperextension of wrist to 135°.

parallel with the median body line, or parallel with the median axis of the limb if the joint is below the elbows or knees (Angle CE, Fig. 3). This may seem confusing at first, especially for the shoulder, but it is consistent with the system, and is not confusing when the system is viewed as a whole.

Adduction is a movement in the same lateral plane as abduction from the straight line of 180° toward the median body line.

The angle measured is that which is included internally between the member moved and the cephalic part of the line through the joint parallel with the median body line. This may be termed the internal-cephalic angle, while that on which abduction is measured may be called the external-cephalic angle.

Rotation is measured on the anterior half of a circle whose center coincides with the axis of rotation and whose plane is perpendicular to that axis (A, Figs. 5, 6, and 7). The scale on this half circle runs from 0° on the inner side to 180° on the outer side

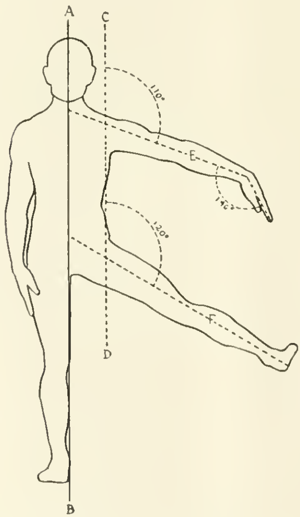

FIG. 3. Abduction, shoulder to 110°, hip to 120°. Flexion of wrist to 140°.

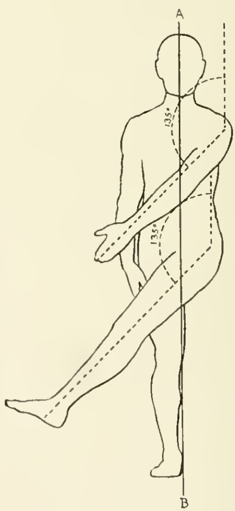

FIG. 4. Adduction, shoulder to 135°, hip to 135°.

of the arc. The diameter of the half circle, the line connecting 0° with 180°, is parallel with the lateral plane of the body. This lateral body plane is the base from which all movements of rotation are measured. Outward rotation is toward 180° and inward rotation is toward 0°. Record is made, for instance, of outward rotation to 120°, or of outward rotation limited to 90° or 80°. In-

ward rotation would normally be expressed in smaller angles, such as 70° or 60°. It is always the internal-anterior angle which is measured. The line which serves as the indicator on the scale is the anterior projection of the anteroposterior line of the member rotated (Line a-p, Figs. 5 and 6). In the neutral position this line is parallel with the sagittal plane of the body and registers 90°.

For three reasons, an exception to this must be made for the radius. The axis of rotation of the radius does not pass through the lower end of the radius, but through the lower end of the ulna. Furthermore, the anterior projection of the anteroposterior line of the wrist would pass entirely clear of the anterior half circle on pronation. Also, the neutral position between supination and pronation of the forearm is that in which the lateral plane of the radio-ulnar styloids is parallel with the sagittal plane of the trunk (A, Fig. 7). The indicating line, then, for recording rotation of the forearm (radio-humeral joint) is the external projection of

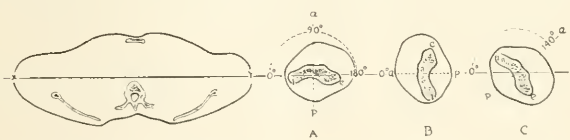

FIG. 5. Rotation of shoulder. X-Y Lateral plane of trunk. a-p Anteroposterior plane of humerus, projected at right angle from lateral plane of humeral condyles. i—Internal condyle., e—External condyle. A—Neutral position. B—Internal rotation to 0°. C—External rotation to 140°.

the lateral line of the radio-ulnar styloids (Line u-r, Fig. 7). Its excursion on the scale corresponds to the excursion of the radial styloid. On complete supination it registers 180° and on complete pronation about 45°. The neutral position is 90°, and the angle measured is always the internal-anterior angle, the same as for rotation of the other joints (Fig. 7). For instance, "supination limited to 120°" or "pronation limited to 80°" would be recorded. If the forearm is fixed so that no rotation is possible it may be spoken of as a "rotation ankylosis" at 80°. This term also applies to all other joints in which rotation is normally possible but in which ankylosis has occurred.

Rotation is measured at the distal end of the bone rotated, with a protractor large enough to form the anterior half circle like an arch over the entire limb. For the shoulder the distal end of

the bone is the humeral condyles (Fig. 5), for the elbow (radio-humeral joint) the radio-ulnar styloids, for the hip, the femoral condyles (Fig. 6), and for the knee, the lower end of the tibia. For the spine, the lateral plane of the pelvis is the base and the anterior projection of the sagittal plane of the trunk and the head is the moving limb of the angle. The scale is read from left to right, the natural direction of reading. Rotation of the spine to the left is toward 0°, and to the right is toward 180°; the neutral position is 90°, and the left-anterior angle is the one measured.

It may be objected that the neutral position from which all these rotary movements start should be 0° instead of 90°, but if 0 were the neutral point there would be a constant source of ambiguity. A statement of 10°, for instance, would not indicate whether

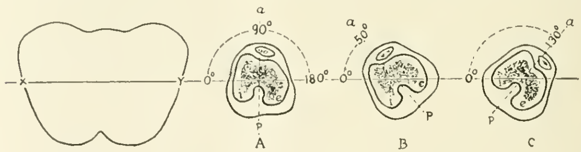

Fig. 6. Rotation of hip. X-Y Lateral plane of trunk. a-p Anteroposterior plane of femur projected anteriorily at right angles to lateral plane of femoral condyles. i—Internal condyle; e—external condyle. A—Neutral position. B—Internal rotation to 50°. C—External rotation to 130°.

the external or internal angle were meant. To be sure, if the record reads "10° external rotation" it may safely be assumed that the external angle is meant, but sometimes external rotation is limited to the internal part of the arc. This is particularly true of the forearm: usually if rotation is sharply limited the forearm is pronated and supination does not go so far as the neutral point. The statement "supination limited to 20°" might mean a very sharp limitation or a very mild one depending on which side of 0° the 20° angle lay. By establishing 90° as the neutral point and recording from 0° on the inside to 180° on the outside of the half circle the record cannot be ambiguous.

Measurements of the angles described in this system are best made with a joint protractor with both limbs about 16 inches long. The margin of error is reduced by having the limbs long and of equal length. It is convenient to have a thumb screw at the center so that the limbs of the protractor may be fixed in position

when the instrument is applied at the proper angle on the joint (Fig. 8). The limbs of the protractor are applied so that they are in line with the bony axes of the parts on either side of the joint which is being measured. A deviation from this method is the commonest source of error. In fleshy persons some difficulty is experienced in applying the protractor in the proper line and in centering it accurately over the joint. For measuring rotation a protractor without limbs or connecting diameter is set over the limb like an arch.

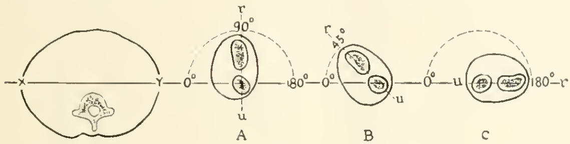

FIG. 8. Application of the protractor to the elbow joint.

The normal limits of motion for each joint as here given can be considered only as approximate since there is a wide variation, dependent on the development of the soft parts and on habits of exercise of different persons. The figures given are for active movements.

SHOULDER JOINTS

The scapula moves more or less with all movements of the humerus, so that the limits of movement in the humeroglenoid articulation alone are not sharply defined.

Flexion, forward and upward (with scapula)	to 50°
Flexion combined with internal rotation	to 0°
Extension, forward and downward	to 180°
Hyperextension, from arm at side, moving backward (with scapula)	to 120°
Abduction (with scapula)	to 0°
Adduction (with scapula)	to 135°
Rotation, internal	to 0°
Rotation, external	to 130°

ELBOW JOINTS

Flexion	to 30°
Extension	to 180°
Rotation (radiohumeral joint)	
Supination (Fig. 7 B)	to 180°
Pronation (Fig. 7 C)	to 40°

WRIST JOINTS

Flexion	to 100°
Extension	to 180°
Hyperextension	to 120°
Abduction (toward radius)	to 165°
Adduction (toward ulna)	to 130°

METACARPOPHALANGEAL JOINTS

Flexion		to 90°
Extension		to 180°
Hyperextension		to 140°
Abduction (toward radius)		
Varies for different fingers	(II Index	to 160°
	(III Middle	to 165°
	(IV Ring	to 170°
	(V Little	to 175°
Adduction (toward ulna)		
Varies for different fingers	(II Index	to 175°
	(III Middle	to 170°
	(IV Ring	to 165°
	(V Little	to 160°

FINGER JOINTS

Flexion (Proximal joint)	to 75°
(Distal joint)	to 90°
Extension, either joint	to 180°
Hyperextension, slight, and quite variable.	

THUMB JOINTS

Trapezium-metacarpal joint.—This joint is theoretically a part of the wrist joint, but its motions are, within certain limits, independent of the wrist, thus differing from the other metacarpals. It is limited more by muscles than by ligaments.

Flexion with wrist	to 90°
Extension	to 180°
Hyperextension (with abduction)	to 110°
(A trifle farther than other metacarpals)	
Abduction	to 130°
Adduction	to 170°
Proximal joint	
Flexion	to 130°
Extension	to 180°
Hyperextension	to 170°

Distal joint	
Extension	to 180°
Flexion	to 90°
Hyperextension	to 160°

SPINAL JOINTS

Any movement of the entire vertebral column, sacrum to atlas, is considered the sum of the movements of all the intervertebral articulations. The angle on which limitation of motion, except rotation, is measured is that between a perpendicular line projected downward (the patient standing) from the lumbo-sacral articulation and a line from this articulation to the atlas.

Rotation is measured by the deviation of the anterior projection of the sagittal plane of the skull from the lateral plane of the pelvis, as described. This gives the total rotation of the entire spine from sacrum to atlas. Rotation of the cervical portion of the spine is much more than that of all the rest of the spine. Keen estimates 25° for the atlanto-axoid joint, 45° for the rest of the neck, and 30° for the dorsolumbar spine on each side. This would give a total rotation excursion of 200° from extreme left to extreme right. It is unusual to find a spine in which that much

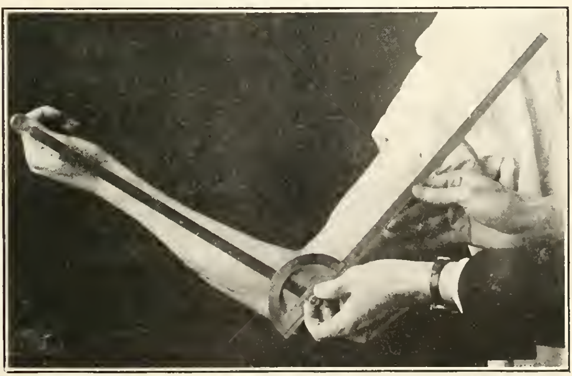

Fig. 7. Rotation of forearm. X-Y Lateral plane of trunk and of the humeral condyles which furnish the base. u-r—Lateral plane of forearm. u Ulnar styloid, r—Radial styloid. A—Neutral position, at 90°. B—Pronation (internal rotation) to 45°. C—Supination (external rotation) to 180°.

rotation is possible, but most spines will rotate through the total anterior half-circle arc of 180°. Movement of the pelvis is, of course, carefully excluded.

Accurate analysis of spinal movements is absolutely impossible because (1) motion is not equally distributed, owing to the difference in thickness of the intervertebral disks, (2) the bodies are not circular and movement is easier in one direction than another, (3) the spine is not straight but curved, and (4) motion varies in different regions. A little more than a fifth of the motion is in the neck and a little less than a third is in the loins. 8 (p. 142)

Limits of motions in the spine have a very wide variation in different persons and in the same person depending, on age and habits of exercise.

Flexion	to 110°
Extension	to 180°
Hyperextension	to 150°
Lateral flexion	to 150°
Rotation (neutral 90°)	
Left (toward 0°)	to 0°
Right (toward 180°)	to 180°

HIP JOINTS

Movements of the pelvis are, of course, excluded.

Flexion (quite variable)	to 60°
Extension	to 180°
Hyperextension	to 160°
Abduction	to 135°
Adduction	to 145°
Rotation, internal	to 70°
Rotation, external	to 135°

KNEE JOINTS

Flexion	to 35°
Extension	to 180°
Hyperextension	to 170°
Rotation, internal (prevented by crucial ligaments)	to 90°
Rotation, external (chiefly passive and only in semiflexion)	to 120°

ANKLE JOINTS

The angle measured is that between the plantar plane of the foot and the long axis of the tibia.

The term "flexion" is used in the clinical sense of dorsal-flexion. The term "extension" is not used because it is confusing when applied to the ankle. There is no extension of the ankle analogous to that of other joints. What is spoken of by anatomists as extension is really a hyperextension, the dorsal-flexion of clinical terminology.

Dorsal flexion	to 75°
Plantar flexion	to 140°

SUBASTRAGALOID JOINTS

Calcaneo-astragalo-scaphoid.—The combined motion of these joints is a twisting rotation. The part which moves depends on whether the movement is produced by manipulation of the foot by the examiner or whether it is produced by the patient's weight in standing. In manipulation, the astragalus is the fixed point and the anterior part of the foot is moved; the scaphoid glides outward and upward over the head of the astragalus in pronation, and downward and inward in supination. When the patient stands, the ball of the foot becomes the fixed point. In pronation the round head of the astragalus rolls inward and downward in the socket of the scaphoid, being pushed in that direction by the weight of the body. The mid tarsus is, of course, carried along inward and downward by the body weight when the movement of the astragalo-scaphoid joint has reached its limit. The os calcis also tilts inward and forward, bringing the calcaneo-astragaloid joint into play.

The reverse movement of supination is active, produced by the posterior tibial, the flexor longus digitorium, and the flexor longus hallucis. The astragalus is pulled upward and outward, its head rotating in the concave articular surface of the scaphoid, the os calcis is straightened up, and the mid-tarsus is raised and carried outward.

Accurate measurement of pronation and supination is hardly possible. The degree of pronation is best observed from directly behind the patient as he stands with feet parallel about 3 inches apart.

MID-TARSAL JOINTS

The mid-tarsal joints include the scapho-cubo-cuneiform and the tarso-metatarsal. The chief movements are abduction and adduction of the anterior part of the foot. These are not pure move-

ments, however; abduction is combined with a certain amount of pronation, and adduction with supination.

There is also slight dorsal and plantar movement. Accurate measurement of these motions is impracticable.

METATARSOPHALANGEAL JOINTS

Theoretically, the metatarsophalangeal joints are capable of the same movements as the corresponding joints of the hands, but owing to immobilization of the toes in shoes the motion is very sharply limited. The usual position of rest is a hyperextension varying from an obtuse angle of about 160° in the first and fifth metatarsophalangeal joints to an angle sometimes as sharp as 90° in the second. Flexion beyond the straight line of 180° is scarcely ever possible in the ordinary foot, except in the great toe which in some cases can be brought a short distance beyond the 180° line and into the flexion arc proper to 170° or possibly 165°. Practically all the movement of these joints, therefore, is in the hyperextension arc.

TOE JOINTS

Motions of the toes are the same as those of the fingers, but very much limited. Flexion is possible to 160° or 150° in some cases and is a little more for the great toe than for the others. Extension is usually not possible beyond about 170° except in the great toe which comes out easily to 180° and may even be hyperextended a trifle.

SPECIAL APPLICATIONS

The carrying angle.—The carrying angle of the elbow is included between the long axis of the humerus and the long axis of the forearm; it averages 164° according to Mikulicz. It is said to be more acute in females than in males on account of the greater width of the pelvis. In cubitus valgus the angle is more acute than normal and measures less than 160°, in cubitus varus it measures 170° or more.

Hallux valgus.—The degree of deformity in hallux valgus is measured on the arc of the angle between the long axis of the first metatarsal and the long axis of the great toe bones. The smaller the angle the greater the deformity.

Coxa vara.—The angle measured lies between the long axis of the femoral neck and the long axis of the shaft. This angle is normally about 125°. 8 (p. 359). In coxa vara it is reduced, sometimes even to 90° or less.

SUMMARY

All joint movements are measured on a half-circle arc from 0° to 180°.

The zero end of this arc is toward the head and the neutral position is 180° for all movements except rotation. For rotation, including pronation and supination, the zero end is toward the median body line (on the left for the spine) and the neutral position is 90°.

Extension is a movement toward 180° and flexion toward 0° on the flexor half-circle arc in the anteroposterior plane.

Hyperextension is a movement toward 0° on the half-circle arc on the extensor side of the joint in the anteroposterior plane.

Abduction and adduction are both movements toward 0° in the lateral plane, the former on the half-circle arc lying external to the joint, and the latter on the half-circle arc lying internal to the joint.

Internal rotation is toward 0° and external toward 180° on the anterior half-circle arc in the transverse plane. For the spine rotation to the patient's left is toward 0° and to his right toward 180°.

The number of degrees stated in records by this system indicates the *limit* of motion on the half-circle scale and not the amount of motion.

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In the November bibliography the article, "The Treatment of Spetic Fractures," was indexed under G. W. Crile. This was a mistake and should be D. W. Crile.

News Notes

The Home of the Merciful Savior for Crippled Children in Philadelphia has just received $10,000 as a bequest from Emily Baker Elliott.

Dr. LeRoy C. Abbott, Major Medical Corps, has assumed his duties as Assistant Professor, Department of Surgery, at the University of Michigan. Dr. Abbott returned to this country during the summer after a year with Sir Harold Stiles at Edinburgh. For two years he was on duty principally in Edinburgh, London and Savenay. His military record was one of exceptionally fine service.

Dr. Clarence E. Coon announces the removal of his office to the Syracuse Clinic, 405 Fayette Park, Syracuse, New York, where he will conduct his practice as a member of a group.

Current Orthopaedic Literature

The Treatment of Injuries to Athletes. By Harry Eaton Stewart, M. D., New Haven, Connecticut. *Jour. A. M. A.*, May 3, 1920, Vol. 74, No. 14.

Most of the injuries due to athletics fall into one of these classes: (1) muscle bruise; (2) torn ligaments; (3) torn muscle insertions; (4) subperiosteal hematoma, or (5) tenosynovitis.

Muscle Bruise.—This injury is the most common we meet in football players. It is usually caused by the shoulder of the tackler hitting the runner with great force on the front of the thigh. There follows at once pain, weakness, swelling and stiffness of the extensors of the leg.

The pathologic condition varies with the force of the blow and the hardness of the player. There may be only a slight bruising, which massage at once and continued light use will entirely eradicate. Generally the muscle fibre will be found torn and matted together with considerable extravasation of blood and lymph.

The muscle should be relaxed, bandaged firmly, and rested 24 hours. After that period, treatment by the application of heat is begun. Baking is good, but does not penetrate deeply as the high frequency does. This current is usually given in the form of direct diathermy. A still more efficacious and better controlled method is by indirect diathermy. With the patient on the autocondensation pad or cushion attached to one pole of the d'Arsonval current, the other pole is applied directly over the injured muscle by the vacuum or, better still, a nonvacuum electrode. It is important to keep this electrode moving rapidly over the surface. A little powder applied to the skin will aid in the ease with which the electrode can be moved. Care must be taken that the cords are insulated; a piece of rubber tubing will serve the purpose. If a steel table is used, one should avoid any possibility of the patient's touching the table during treatment.

Massage is begun the second or third day, very gently at first, only effleurage and light petrissage being used. During succeeding days the massage should be given with greater vigor. Tapotement or even the high power motor vibrator may be necessary to free the muscle fibers. These measures should be resorted to at once when the case is not seen until several days after the injury.

In a few of the cases the injury was at first deemed slight and received vigorous treatment at the hands of the team "rubber."

Torn Ligaments.—Sir Robert Jones has given us the key to the proper treatment of these injuries: relaxation, partial protection, and guarded but constant use. For example, a tear of the external lateral ligament of the ankle. Raising the outer side of the heel and a reversed flat-foot strapping would secure the relaxation and protection necessary. Gradually increased walking on the level with a graded schedule of carefully applied passive, and resistive movements will bring quicker results than complete immobility,

which is often followed by a long period of distressing stiffness. The use of heat, diathermy, and massage will greatly hasten the repair process.

Torn Muscle Insertions.—These injuries are encountered in football and basketball, but are most common in track athletics, frequently following sprints and sprint starts before the runner has thoroughly warmed up. The general course of the treatment is the same as that already outlined, except that the relaxation must be complete, secured by splints or sand bag, if necessary, and held at least two weeks before active treatment is instituted; and care must be taken not to tear the newly formed atachments.

Subperiosteal Hematoma.—This is the true "Charlie horse" for which the muscle bruise is so commonly mistaken. It should be treated by rest and firm bandaging until the hemorrhage is stopped, and then by heat and massage to promote absorption of the clot. The massage should be confined to frictions and deep stroking.

Tenosynovitis.—We find this condition early in the season in most sports, and generally confined to the Achilles tendon. It may follow the distance runner all thru the track season. Acute conditions demand absolute rest, heat and gentle stroking. Chronic cases clear up with remarkable rapidity when treated with indirect diathermy and massage. In some of these cases the tendosynovial fluid will be found inspissated, and at times solidified and broken up. More prolonged and intense heat and massage with friction are indicated.

BONE CHANGES IN FEET FOLLOWING FRACTURE OF VERTEBRA. Lloyd Bryan, M. D. *Am. Jr. Roentgenology*, 1920, Vol. VII, page 3.

Attention is called to the fact that bone changes are associated with nerve lesions and are frequent. Among these are Charcot joints and changes in the phalanges, metacarpals and metatarsals in leprosy, and syringomyelia. Little attention has been given to the bony changes in legs and feet following fracture of the vertebra, hence these cases.

The first is that of a man who eleven years previous had fallen from a scaffold, fracturing the spine and giving typical symptoms. To the present the sensory disturbance of feet and legs had not improved; the legs showed muscular atrophy and the toes plantar flexion. Contracture had necessitated amputation of the second and third digits of right foot three years ago, and of the fourth digit of left foot one year ago. There was a small ulcer of the left foot at base of fifth digit.

Roentgen examination showed flattening and thickening about superior surface of both ankles. There was a loose fragment on the right side. The left foot showed dislocation of the third metatarsal phalangeal articulation and erosion of the distal end of proximal phalanx and sharp spur on lateral surface. The proximal phalanx of the fifth digit showed erosion of the base and hyper trophic changes. Relatively similar pathological changes were demonstrated in various parts of the right foot.

The other is a case of fractured vertebra eight years previous, the left limb only being affected. He now has anesthesia of left heel and posterior

portion of ankle, plantar and dorsal surfaces of lateral portion of foot corresponding to the cutaneous supply of the external saphenous and internal calcaneus and external plantar nerves. There was an ulcerative area on the plantar surface of left heel, and sinus leading to the bone. Roentgen examination showed increased density of os calcis of lower two-thirds. Plantar surface is broken up into several fragments, and hypertrophic changes exist.

The deduction from these cases is that the bony changes may be accounted for by the theory of repeated trauma to bones or joints lacking the warning sense of pain.

Reposition and Retention of Fractures by Means of Screw and Plaster Splint. By Kurt Ansinn. *Archiv f. Orthopaed. u. Unfall-Chirurgie.* XVI Band. 4 Heft. June, 1919, page 548.

The author describes a new and very simple method to gain perfect apposition of the fractured ends, whenever traction has failed and open operation is undesirable.

The technic is as follows: A long screw (a) is driven into the fragment which cannot be reduced. The screw is placed perpendicularly to the bone. After that a plaster of Paris splint is applied leaving the end of the screw out of it. Over the protruding part of the screw a metal disc (b) is placed and

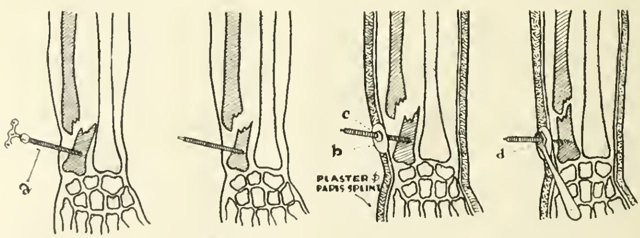

FIG. 1 FIG. 2 FIG. 3 FIG. 4

a nut is screwed on. After the splint has hardened, the nut is tightened with a key (d) until the fragments are in apposition. This process takes place behind a fluoroscope. The screw is left in place about 14 days. At this time it is removed with ease and safety that the fragments will hold since consolidation has already occurred.

The author has used this method in various cases and with great success.

These illustrations of one of the quoted cases in the article speak for themselves and do not need further explanation.—*A. Gottlieb, M. D., San Francisco, Calif.*

OSTEOMALACIA: A STUDY OF THE EFFECTS OF CERTAIN ORGAN EXTRACTS AND OOPHORECTOMY ON THE METABOLISM OF CALCIUM AND MAGNESIUM. By Hugo A. Freund, A. B., M. D., and Bruce C. Lockwood, A. B., M. D., Detroit, Mich. *Annals of Medicine*, Vol. 1, April, 1920.

The investigation is the result of an opportunity which the writers have had of studying, clinically, and investigating the chemical pathology of a case of osteomalacia.

Examination of the pelvis reveals a slightly relaxed vaginal outlet. There is a slight tear of the cervix. The uterus is in good position. The adnexa are not felt.

Extremities.—The lower third of the right tibia is deformed. There are two small irregular callus-like formations felt on the anterior surface at about the middle third, very tender to the slightest pressure. There are two similar areas on the right tibia. All the bones of the lower extremities are very sensitive to pressure. There are two similar areas on the right tibia. All the bones of the lower extremities are very sensitive to pressure, especially the bones of the pelvic girdle.

Roentgen examination.—These were made of the long bones. The plates show a widespread decalcification with loss of the trabeculations and thinning of the cortex. In the middle third of the humerus and in the upper third of the tibia there are fractures. There is a small amount of callus. The writers would class these as pathological fractures.

X-ray of the head was negative. Sella of normal size and outline.

Soon after osteomalacia was first recognized as a disease, it was shown by clinical and anatomical observation that it was not identical with rickets. It was demonstrated that it was a decalcification of the bone similar to that which takes place when bone is placed in hydrochloric acid.

The essential changes as found in the inorganic constituents of bone that occur in osteomalacia are a loss of calcium content with an increase in the amount of magnesium content. It is assumed that the latter is laid down to compensate for the loss of the former.

Pathological Observations.—The bones in osteomalacia are soft and can often be squeezed or twisted. On section, cystic cavities of various sizes are often seen, much reducing the bone substance. In consequence, the specific gravity is often reduced from 1.877 to as low as 0.72. The bones are easily penetrated by the roentgen rays, depending upon their decreased density.

On microscopical examination, osteoid tissue is found in the interior of the bone in proximity to the Haversian canals. In rickets, similar osteoid tissue is found at the junction of the epiphysis and diaphysis and beneath the periosteum and is considered new bone. There is reason to assume that the osteoid tissue in osteomalacia is also new tissue. von Recklinghausen calls attention to the abundance of osteoblasts and Sharpey's fibers, and to the "youthful" appearance of many of the bone corpuscles as evidence that the osteoid tissue is new tissue.

From their observations the writers conclude that their work bears out

the results of other investigations, viz., that there is a marked calcium loss. The magnesium was not retained in this case but showed a minute loss.

In contrast to other cases the greater amount of calcium was excreted thru the urine. The administration of glandular extracts exhibited a striking effect in but one instance. This could not be followed up after all analyses were completed because the patient passed out of their control.

The results were as follows:

1. During thyroid administration there was a marked increase in the loss of both calcium and magnesium.

2. After pituitrin there was a still greater loss of calcium while the magnesium was scarcely affected.

3. During parathyroid administration there was a retention of both calcium and magnesium.

4. After removal of the ovaries there was a much greater loss of calcium and a slightly greater loss of magnesium than at any preceding observation.—*Leo C. Donnelly, Detroit.*